

WEST VIRGINIA UNIVERSITY BULLETIN



GRADUATE SCHOOL 1981-82 CATALOG

Cover: West Virginia University's new Evansdale Library cost \$4.5 million, can seat more than 500 persons, and houses 275,000 volumes.

Energy research is a long-time commitment of West Virginia University, which is located in the heart of the eastern coal fields. The WVU program has been described as "the most comprehensive, multidisciplinary, coal-oriented energy research program at any institution of higher education in the U.S." This research involving more than 40 disciplines is coordinated by the WVU Energy Research Center, which includes one of 22 federally financed Mining and Mineral Resources Research Institutes.



WEST VIRGINIA UNIVERSITY

1981-82 Graduate School Catalog

The 1981-82 West Virginia University Graduate School Catalog must be considered as a general source of information about course offerings, academic programs and requirements, expenses, rules, and policies. The courses, requirements, and regulations contained herein are subject to continuing review and change by the West Virginia Board of Regents, the administrators of the University, and the faculties of schools and colleges in order to best meet the goals and objectives of the University. The University therefore reserves the right to change, delete, supplement or otherwise amend at any time the information, course offerings, requirements, rules and policies contained herein without prior notice.

1981

JANUARY	FEBRUARY	MARCH	APRIL
S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
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1982

JANUARY	FEBRUARY	MARCH	APRIL
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UNIVERSITY CALENDAR, 1981-82

Summer Sessions, 1981

May 18, Monday Registration, First Summer Session
May 18, Monday First Classes
May 19, Tuesday Malcolm X's Birthday—Day of Special Concern
May 25, Monday Memorial Day Recess
June 30, Tuesday Last Classes
June 30, Tuesday Registration, Second Summer Session
July 1, Wednesday First Classes
July 3, Friday Independence Day Recess
August 12, Wednesday Last Classes

First Semester, 1981-82

August 20, 21, Thursday and Friday New Student Orientation
August 21, Friday Registration
August 24, Monday First Classes
September 7, Monday Labor Day Recess
September 29-30, Tuesday and Wednesday Rosh Hashanah—
Days of Special Concern
October 8, Thursday Yom Kippur—Day of Special Concern
October 9, Friday Mid-Semester
October 9, Friday Mid-Semester Reports Due
November 21, Saturday,
to November 29, Sunday, incl. Thanksgiving Recess
December 11, Friday Last Classes
December 14, Monday,
to December 19, Saturday, incl. Final Examinations
December 20, Sunday,
to January 7, Thursday, incl. Christmas Recess

Second Semester, 1981-82

January 8, Friday Registration
January 11, Monday First Classes
January 15, Friday Martin Luther King's Birthday—
Day of Special Concern
February 7, Sunday (not a holiday) West Virginia University Day
February 15, Monday Washington's Birthday Recess
February 26, Friday Mid-Semester
February 26, Friday Mid-Semester Reports Due
April 3, Saturday, to April 12, Monday, incl. Spring Recess
April 12, Monday Easter Recess
April 13, Tuesday Faculty Assembly
April 30, Friday Last Classes
May 3, Monday, to May 8, Saturday, incl. Final Examinations
May 10, Monday Grade Reports for All Graduates
Due in Dean's Office
May 11, Tuesday Dean's Reports for All Graduates Due in
Office of Admissions and Records
May 15, Saturday Alumni Day
May 16, Sunday Commencement

The academic year is divided into two semesters of approximately seventeen weeks each and summer sessions.

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Edited by Stanley J. Nels
Associate University Editor

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West Virginia University is an Equal Opportunity-Affirmative Action institution. In compliance with Federal Executive Order No. 11246 as amended, Title VII of the Civil Rights Act, West Virginia Human Rights Act, Title IX (Educational Amendments of 1972), Sections 503 and 504 of the Rehabilitation Act of 1973, and other applicable laws and regulations, the University provides equal opportunity to all prospective and current members of the student body, faculty, and staff on the basis of individual qualifications and merit without regard to race, sex, religion, age, national origin, or handicap, as identified and defined by law.

The University neither affiliates knowingly with nor grants recognition to any individual, group, or organization having policies that discriminate on the basis of race, color, age, religion, sex, national origin, or handicap, as defined by applicable laws and regulations.

— Office of the President

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Morgantown, WV 26506**

Part 1

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University Hospital, Eugene L. Staples, M.H.A., Administrator

West Virginia University is a member of the North Central Association of Colleges and Schools. The University's educational programs are accredited by the North Central Association and by the appropriate accreditation agencies for the professional schools.

Distinguished Professors

Orrin B. Conaway, Jr., Ph.D., *Claude Worthington Benedum Professor of American Government and Administration*

Bernard R. Cooper, Ph.D., *Claude Worthington Benedum Professor of Physics.*

Samy E. G. Elias, Ph.D., *Claude Worthington Benedum Professor of Transportation.*

Edmund B. Flink, M.D., Ph.D., *Claude Worthington Benedum Professor of Medicine.*

Gabor B. Fodor, Ph.D., *Centennial Professor of Chemistry.*

Ruel E. Foster, Ph.D., *Claude Worthington Benedum Professor of American Literature.*

Frank Gagliano, M.F.A., *Claude Worthington Benedum Professor of Theatre.*

Frank M. Kearns, A.B., *Claude Worthington Benedum Professor of Journalism.*

Jay H. Kelley, Ph.D., *Distinguished Professor of Mineral and Energy Resources.*

Thomas P. Meloy, Ph.D., *Claude Worthington Benedum Professor of Chemical Engineering.*

William H. Miernyk, Ph.D., *Claude Worthington Benedum Professor of Economics.*

Franklin Parker, Ed.D., *Claude Worthington Benedum Professor of Education.*

Hayne W. Reese, Ph.D., *Centennial Professor of Psychology.*

Martin W. Schein, Sc.D., *Centennial Professor of Biology.*

C. Y. Wen, Ph.D., *Claude Worthington Benedum Professor of Chemical Engineering.*

Graduate Education at WVU

Graduate education has a long and honored history. It can be traced to the medieval universities of Europe, and the goal for graduate study has remained unchanged over the intervening centuries. A student undertakes such study in order to gain a deepening of knowledge in a particular academic discipline, and to become able to demonstrate to the faculty and practitioners in the field the attained mastery of knowledge. Consequently, graduate study cannot be defined primarily in terms of semester hours of course work beyond the baccalaureate, even though minimum course work requirements are commonly specified for graduate degrees. Minimum requirements set the lower limit for an integrated plan of study which will provide a student with opportunity for the desired deepening of knowledge.

The word university comes from a Latin expression meaning "a corporate community of scholars," and graduate students are expected to become participating members of that community. Even when not in class, graduate students traditionally have access to the informal academic activities of their discipline. They are encouraged to attend the talks presented by visiting scholars, to listen to academic discussions of their faculty, to serve on departmental committees, and to study with their fellow graduate students. The purpose of residency requirements is to promote such participation in the academic affairs of the university.

At West Virginia University the minimum standards for admission to graduate study are set by the WVU graduate faculty. Beyond this point, however, faculty members in a given graduate program have complete control over who is to be admitted to undertake graduate study under their supervision;

and ultimately it is they who certify which students have demonstrated sufficient mastery of the discipline to qualify for a graduate degree. While the Dean of the Graduate School may admit a student for the purpose of enrolling in advanced course work, only the program faculty may grant permission for the pursuit of a degree. Likewise, the Graduate Dean will not recommend a student for a degree until the graduate faculty of a program has indicated in writing that the student has gained the desired deepening of knowledge.

The Graduate School is an integral part of West Virginia University. It subscribes to this mode of graduate study which has been tested through centuries of practice at the great universities of the world. The purpose of the *Graduate School Catalog* is to reflect this commitment and to set forth the policies and rules for graduate education as they have been determined by the Graduate Faculty and are administered by the Dean of the Graduate School. The enrollment of all graduate students is in the Graduate School, not in one of the other schools or colleges, and the graduate students' dean is the Graduate Dean. It is thus essential that all students beginning study at the graduate level become familiar with regulations for graduate study in general, as well as with the requirements of their own programs—both of which are detailed in this *Catalog*. Each student should request a *Graduate School Catalog* when beginning graduate study, and become conversant with its contents.

West Virginia University, which is both the comprehensive and land-grant university in the West Virginia system of higher education, offers graduate work — directed and administered by the Graduate School — in more than 70 subject-matter fields in some 40 departments or divisions of 14 schools and colleges and by some interunit committees drawn from two or more of the schools and colleges.

Government and Organization of WVU

The *West Virginia Board of Regents* is vested by law with authority for the control and management of the University and all other state institutions of higher education. Serving on the Board are nine members appointed by the Governor, with advice and consent of the Senate, and three ex officio members including a faculty member chosen by the Regents' Advisory Council of Faculty and a student named by the Regents' Advisory Council of Students, both of whom vote, and the State Superintendent of Schools.

The president, appointed by the Board of Regents, is the chief executive officer of the University, as well as its principal academic officer — a role which his position as presiding officer of the University Senate symbolizes.

The *University Senate* is the vehicle for faculty participation in the governance of the University. It is a legislative body with original jurisdiction over all matters of academic interest and educational policy that concern the entire University or affect more than one college or school. The Senate's decisions are subject to review and approval by the president and the Board of Regents. The Senate includes the president of the University as chairperson, vice-presidents, academic deans, five administrative officers appointed by the president, and senators elected by members of the University Faculty Assembly to represent their colleges and other constituencies. Each constituency is entitled to one senator for each twenty constituents who are members of the University Faculty Assembly. The Senate normally meets once each month.

The Senate Executive Committee elects a faculty chairperson each year who represents the faculty on the President's Academic-Administrative Council, on the University Budget Team, and at Staff Council meetings. Two faculty members also serve on the Vice-Presidents' Advisory Committee for Promotion and Tenure.

Others serving on the Academic-Administrative Council include vice-presidents, executive officer, assistant to the president (for legal affairs), assistant to the president for public affairs, special assistant to the president and coordinator of equal employment opportunity and affirmative action affairs, staff council president, and student body president. Other members of the Budget Team are the vice-presidents and executive officer.

The *University Faculty Assembly* includes the president as presiding officer, vice-presidents, academic deans, associate deans, professors, associate professors, assistant professors, and instructors holding appointments on a full-time basis. The assembly meets once a year in April.

West Virginia University also has a tradition of strong *Student Administration* that touches all aspects of student life and represents student opinion to the administration and faculty. Student Administration has two main branches: the Executive and the Board of Directors (a policy-making group composed of thirteen members which functions in the dual role of a legislative and judicial arm). Students serve on 25 University-wide committees, including University Senate committees, the Committee on Student Discipline (two student members and three faculty members), and the Mountainlair Advisory Council (four students and four faculty members).

For nonteaching employees, there is the *Staff Council*, which consists of twelve members elected by their fellow employees in six occupational groups, and Laborers' International Union Local 814, AFL-CIO, which represents many employees.

Morgantown Area

Greater Morgantown has a population of 45,000; Monongalia County, 75,000. Monongalia is one of the largest deep-mine, coal-producing counties in the nation. WVU is the largest single employer.

Located on the east bank of the Monongahela River, which flows north to nearby Pittsburgh, Pa., Morgantown is situated on rugged terrain of the Appalachian highlands. The altitude of the city varies from 800 to 1,150 feet above sea level, and the surrounding hills rise eastward to Chestnut Ridge and reach an altitude of 2,600 feet just ten miles from the city.

The area's temperate climate is marked by four distinct seasons of about equal length. Morgantown averages 40 inches of precipitation a year. Rainy days are fairly common. Falls are beautiful with the hills turning red, orange, and yellow as the leaves change color.

Morgantown is served by Greyhound Bus Lines and by AeroMech Airlines. A north-south interstate highway, I-79, is one mile west of Morgantown. U.S. Routes 19 and 119 also pass through Morgantown in the north-south direction. U.S. 48 — a four-lane, east-west highway — ties I-79 and I-81 together between Morgantown and the Cumberland-Hagerstown, Md., region.

Because of WVU's intellectual resources, the Morgantown area is becoming the major research center in the Appalachian region. Four federal agencies have research facilities in the area — Department of Health and Human Services (Appalachian Laboratory for Occupational Safety and Health), Forest Ser-

vice (Forestry Sciences Laboratory), Morgantown Energy Technology Center of the U.S. Department of Energy, and Soil Conservation Service (West Virginia headquarters).

Two installations add to the area's variety. They are the Robert F. Kennedy Center, a model federal prison; and an earth tracking station of the Communications Satellite Corporation at Etam in neighboring Preston County (its 97-foot diameter antenna sends and receives world-wide telephone and other communications from satellites in outer space).

Housing

More than half of WVU's 19,000 students on the Morgantown campuses live in private rental housing — 3,600, mostly freshman students, in University-owned residence halls and 500 in University apartments valued at \$50 million; 3,000 in privately owned dormitories and fraternity and sorority houses; 2,200 commute from their parents' homes; and 9,700 in apartments, mobile homes, and private rooms.

The University Housing Office, 440 Medical Center Drive (phone 304 293-3621), provides information concerning both University-owned and privately owned off-campus housing.

Listings for privately owned rentals change daily so students must visit the Housing Office to see what is available and make their own arrangements with landlords.

Students are advised to obtain housing well in advance of the beginning of the academic year because the housing supply is considered tight in the Morgantown area. Because of the hilly terrain, parking also is extremely limited on the WVU campuses and in the city.

Library Services

The West Virginia University Libraries contain over a million items including more than 960,000 books and 750,000 microforms and microfilms. Some 30,000 volumes are added each year, and over 9,425 periodical titles are received.

The collections are especially strong in the biological sciences, chemistry, engineering, sociology and anthropology, Africana, the Southern Appalachians, and West Virginia history. Facilities for research in West Virginia and regional history are centered in the West Virginia Collection, located on the second floor of Colson Hall. In addition to an extensive collection of books, periodicals, and maps, the Collection contains over three million manuscripts. These, together with court records from many counties, are invaluable sources for the study of all aspects of West Virginia history.

The Rare Book Room contains an unusually fine collection of first and limited editions, including the four Shakespeare folios, and the first editions of many of the works of Dickens, Scott, and Clemens.

The Evansdale Library houses the collections needed to support those units located on the Evansdale Campus: Agriculture, Engineering, Human Resources and Education, Social Work, Physical Education, and Art and Theatre.

The Physical Sciences Library of 37,000 volumes in the fields of chemistry, geology, physics, and astronomy is in the Chemistry Research Laboratory.

The Medical Center Library on the second floor of the Basic Sciences Building contains 130,000 volumes with a complete public catalog. Author cards for titles in the Medical Center Library appear in the central Library catalog.

The Law Library, with a collection of 115,000 volumes, is in the Law Center on the Evansdale Campus.

The Mathematics Library in Eiesland Hall contains approximately 11,000 volumes.

The Music Library in Room 424-A, Creative Arts Center, contains some 20,000 items which include microcards, microfilms, and recordings, as well as books and scores.

Audiovisual departments are located in Colson Hall and the Medical Center Library. A catalog of all audiovisual holdings is available at both locations and at the various libraries.

Computing Services

West Virginia University computer users are provided services by two interacting units: the West Virginia Network for Educational Telecomputing (WVNET) and WVU Computing Services. Processing capabilities are provided by hardware and software located primarily in the network main site and delivered to all state-supported colleges and universities by teleprocessing methods. Computing Services in the University coordinates availability of these services and provides others as noted below.

Detailed questions about WVNET should be directed to the WVNET Information Controller, 837 Chestnut Ridge Road, Morgantown, WV 26505, 304-293-5192. Other questions about the WVU computing environment may be directed to WVU Computing Services, 17 Grant Avenue, Morgantown, WV 26506, 304-293-3011.

Continuous upgrades in equipment, software, and services preclude exact descriptions. As of September 30, 1980, however, WVNET hardware included:

Computers — One Amdahl 470 V/7A (8 megabytes high speed memory); two DEC VAX 11/780's (5 megabytes ECCMOS memory and 310 megabytes disk memory each); and one DEC PDP 11/44 (512 kilobytes ECCMOS memory and 56 megabytes disk memory).

Direct Access Devices — Two IBM 2303 magnetic drums, six spindles of ITTEL 7350 disk storage, eight spindles of IBM 3350 disk storage, eight spindles of IBM 2314 Model 1 disk storage, and twelve spindles of IBM 3330 Model 11 disk storage.

Tape Devices — Three IBM 2401 Model 2 and ten IBM 3420 Model 6 tape drives.

Units Record Devices — Two 1,100 line-per-minute IBM 1403 printers, a Zeta 3600X plotter and microfilm/fiche processors and duplicators.

System software consists of VM Release 7 and VSI Release 6.7. Remote batch and conversational terminals are served by HASP and MILTEN via an IBM 3705 communications controller. The CMS timesharing system and OBS WYLBUR text editor, both running on the Amadahl V/7A, are available to all network users.

Programming languages and packages available via WVNET include current versions of Cobol, Fortran, and PL/1. Also supported are: The International Mathematical and Statistics Libraries (IMSL), the North Carolina State Statistical Analysis System (SAS), the UCLA-developed Biomedical package (BMD), the University of Chicago's Statistical Package for the Social Sciences (SPSS) and Harvard's DATA-TEXT.

West Virginia University computer users access network hardware and software via five University computer sites or through equipment purchased for

use by specific departments. Equipment currently available for use includes an IBM 1130, two DEC PDP 11 10's, one DEC PDP 11 44, an IBM System 34, and data processing equipment available in individual University units. Key punch machines and card readers are available primarily in batch processing sites. Timesharing sites contain numerous CRT and "hardcopy" terminals with graphics facilities available. Standalone Apple II microcomputers, running PASCAL and BASIC and providing graphics capabilities are also available for general use.

Computer-related services accessible by University computer users holding valid, active WVU computer accounts include:

Computer Site Operations — Batch processing/remote job entry sites for academic users are located in Colson Hall and the Evansdale Library. Key punches, card readers, and a limited number of teleprocessing terminals are available in these sites from 8:15 a.m. to 2:00 a.m. weekdays and 9:00 a.m.-6:45 p.m. on Saturdays. Timesharing sites located in Eiesland Hall and the Engineering Sciences Building are open from 9:00 a.m.-10:00 p.m. weekdays and 10:00 a.m.-3:00 p.m. on Saturdays. Operators are on duty in batch/remote job entry sites to assist users with data input and control output. Documentation libraries are located in all sites for user reference.

Consulting — Program consultants are available at most WVU computer sites during posted hours. Consultants will assist users with problems concerning system requirements, language specifications, and general programming.

Programming — The programming and analysis staff provides specialized programs for all University units. Services include special reporting, production of permanent programs, and documentation. Principal programming languages used for administrative applications include MARKIV, PL1, COBOL, and RPG with PANVALET for software library maintenance.

Production — Personnel enter large volumes of data into IBM 3741/2's for transmission to WVNET. Other production staff members expedite processing of all WVU financial, personnel and student records systems.

Test Scoring — Optical page reader test scoring is available to all WVU faculty and staff members through the Production Services unit.

Veterans Educational Assistance

The Veterans Administration (VA) administers two basic programs for veterans and service persons seeking assistance for education or training. For eligible persons with service between February 1, 1955, and December 31, 1975, such assistance is available under the G.I. Bill. Veterans and service persons who initially entered the military on or after January 1, 1977, may receive educational assistance under a contributory plan.

Information regarding these educational opportunities at WVU may be obtained from the Veterans Coordinator, by personal conference at his office in the Mountainlair or by mail. Dependents of 100 percent disabled veterans may also be eligible for benefits.

Foreign Students

The Foreign Student Office in Moore Hall is the focal point for guidance and counseling of all foreign students at WVU. All new foreign students are required to report to the office as soon as they come to the campus.

Orientation programs for all new foreign students are directed by the Foreign Student Adviser and staff and offer credit during the summer course. Foreign students are encouraged to join the International Student Association in addition to their particular nationality organization. Programming includes travel and homestay suggestions for vacation times as well as activities on campus and in the community.

The Testing of English As a Foreign Language (TOEFL) must be taken by all foreign students before they can be admitted to WVU.

Degree Programs Offered by WVU

College of Agriculture and Forestry

Major or Degree Program	Bachelor	Master	Doctorate
Agricultural Biochemistry		M.S.	Ph.D.
Agricultural Economics		M.S.	
Agricultural Education	B.S.Agr.	M.S.	
Agricultural Microbiology		M.S.	Ph.D.
Agriculture		M.Agr.	
Agronomy		M.S.	Ph.D.
Animal Nutrition			Ph.D.
Animal Science		M.S.	
Animal and Veterinary Sciences	B.S., B.S.Agr.		
Entomology		M.S.	
Forest Resources Management	B.S.F.		
Forest Resources Science			Ph.D.
Forestry		M.S.F.	
Horticulture		M.S.	
Landscape Architecture	B.S.L.A.		
Plant Pathology		M.S.	Ph.D.
Plant and Soil Sciences	B.S.Agr.		
Recreation and Parks Management	B.S.R.	M.S.	
Resource Management	B.S., B.S.Agr.		
Wildlife Management		M.S.	
Wildlife Resources	B.S.		
Wood Industries	B.S.F.		

College of Arts and Sciences

Biology	B.A.	M.S.	Ph.D.
Chemistry	B.A., B.S.	M.S.	Ph.D.
Computer Science	B.S.	M.S.	
Economics	B.A.		
English	B.A.	M.A.	Ph.D.
Foreign Languages	B.A.	M.A.	
Geography	B.A.		
Geology	B.A., B.S.	M.S.	Ph.D.
History	B.A.	M.A.	Ph.D.
Interdepartmental Studies	B.A.		
Mathematics	B.A.	M.S.	
Philosophy	B.A.		
Physics	B.S.	M.S.	Ph.D.
Political Science	B.A.	M.A.	Ph.D.
Psychology	B.A.	M.A.	Ph.D.
Public Administration		M.P.A.	
Sociology and Anthropology	B.A.	M.A.	
Speech Communication	B.A.	M.A.	
Statistics	B.S.	M.S.	

Board of Regents Bachelor of Arts Degree

(Intended for older students who wish to resume and complete their college studies. Detailed information available from the Coordinator, Board of Regents B.A. Degree Program, Student Services Center, West Virginia University, Morgantown, WV 26506.)

College of Business and Economics

Accounting	B.S.B.Ad.		
Business Administration	B.S.B.Ad.	M.B.A.	
Business Management	B.S.B.Ad.		
Economics	B.S.	M.A.	Ph.D.
Finance	B.S.B.Ad.		
Industrial Relations		M.S.	
Marketing	B.S.B.Ad.		
Professional Accountancy		M.P.A.	

Creative Arts Center

Art	B.A.	M.A.	
Music	B.M.	M.M.	D.M.A., Ph.D., Ed.D.
Theatre	B.F.A.	M.A.	
Visual Art	B.F.A.	M.F.A.	

School of Dentistry

Dental Hygiene	B.S.	
Dentistry		D.D.S.
Endodontics	M.S.	
Orthodontics	M.S.	

College of Engineering

Engineering	M.S.E.	Ph.D.
Aerospace Engineering	B.S.A.E.	M.S.A.E.
Chemical Engineering	B.S.Ch.E.	M.S.Ch.E.
Civil Engineering	B.S.C.E.	M.S.C.E.
Electrical Engineering	B.S.E.E.	M.S.E.E.
Environmental/Occupational Health Studies		M.S.
Industrial Engineering	B.S.I.E.	M.S.I.E.
Mechanical Engineering	B.S.M.E.	M.S.M.E.

College of Human Resources and Education

Education		C.A.S., Ed.D.
Community Health Education	M.S.	
Counseling and Guidance	M.A.	
Education Administration	M.A.	
Educational Psychology	M.A.	
Elementary Education	B.S.E.Ed.	M.A.
Family Resources	B.S.Fam.Res.	M.S.
Reading		M.A.
Rehabilitation Counseling	M.S.	
Secondary Education	B.S.S.Ed.	M.A.
Special Education	M.A.	
Speech Pathology and Audiology	B.S.	M.S.

Interdisciplinary Programs

Genetics and Developmental Biology	M.S.	Ph.D.
Reproductive Physiology	M.S.	Ph.D.

School of Journalism

Journalism	B.S.J.	M.S.J.
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College of Law

LawJ.D.

School of Medicine

AnatomyM.S.Ph.D.
 Biochemistry (Medical)M.S.Ph.D.
 Medical TechnologyB.S.M.S.
 MedicineM.D.
 Microbiology (Medical)M.S.Ph.D.
 Pharmacology and ToxicologyM.S.Ph.D.
 Physical TherapyB.S.
 Physiology (Medical)M.S.Ph.D.
 Biomedical SciencesPh.D.*

College of Mineral and Energy Resources

Engineering in cooperation with College of EngineeringPh.D.
 Engineering of MinesB.S.E.M.M.S.E.M.
 Mineral and Energy ResourcesM.S.Ph.D.
 Mineral Processing EngineeringB.S.
 Petroleum EngineeringB.S.Pet.E.M.S.Pet.E.

School of Nursing

NursingB.S.N.M.S.N.

School of Pharmacy

Pharmaceutical SciencesM.S.Ph.D.
 PharmacyB.S.Pharm.

School of Physical Education

Education in cooperation with Human
 Resources and EducationC.A.S.,
 Ed.D.
 Physical EducationB.S.P.Ed.M.S.
 Physical Education Interdisciplinary ..B.S.P.Ed.
 Safety StudiesM.S.

School of Social Work

Social WorkB.S.W.M.S.W.

*Awarded under the auspices of the degree-granting authority of WVU, but in cooperation with the Basic Sciences Departments of Marshall University School of Medicine.

Academic Common Market

West Virginia provides its residents opportunity, through the Academic Common Market (ACM) and through contract programs, to pursue academic programs not available within the state. Both programs permit West Virginians to enter out-of-state institutions at reduced tuition rates. Currently there are more than a hundred master's and doctoral programs available through ACM. Since 1974, when the state began participating in the ACM, 70 students from West Virginia have enrolled in degree programs in other states.

Contract programs have been established for study in veterinary medicine, optometry, architecture, and podiatry. The Academic Common Market provides access to numerous graduate programs. The programs are restricted to West Virginia residents who have been accepted for admission to one of the specific programs at designated out-of-state institutions.

Through reciprocal agreement WVU allows residents of states within the Academic Common Market to enroll in specific graduate programs on an in-state tuition basis.

Further information may be obtained through the Graduate Dean. In each case application must be made through the higher education authority of the state of residence. For West Virginia residents this is the West Virginia Board of Regents, 950 Kanawha Boulevard, East, Charleston, WV 25301.



Part 2

GRADUATE SCHOOL

Administration

Stanley Wearden, *Dean.*

Darlene Taylor, *Graduate Fellowship Coordinator.*

Virginia E. Isner, *Graduation Clerk.*

Graduate School Executive Committee

Stanley Wearden, Ph.D., (*ex officio*), *Dean (Chairperson).*

Barton Hudson, Ph.D., *Professor of Music.*

E. Keith Inskeep, Ph.D., *Professor of Animal Science.*

Patrick C. Mann, Ph.D., *Associate Professor of Economics.*

John W. Mauger, Ph.D., *Associate Professor of Pharmacy.*

Anne H. Nardi, Ph.D., *Associate Professor of Educational Psychology.*

P. Michael Ryan, Ph.D., *Professor of Journalism.*

Robert E. Swartwout, Ph.D., *Professor of Electrical Engineering.*

David G. Temple, Ph.D., *Professor of Political Science.*

David B. Yelton, Ph.D., *Associate Professor of Microbiology.*

Governance

The Graduate School, as distinct from the other colleges and schools, is University-wide, drawing together all the University's faculties and students concerned with graduate study. The Graduate Faculty is empowered to establish policies and regulations covering: the introduction of degree programs; degree, curricular, thesis, and dissertation requirements; standards of student scholarship; residency rules, etc.; and these policies and regulations take precedence over those of particular colleges, schools, and departments.

All decisions on major policies and regulations which affect the introduction of new degree programs and graduate study in general are based on recommendations made by the Graduate Faculty, after study and advice by the Executive Committee of the Graduate Faculty and the Dean of the Graduate School.

Nominations for membership in the Graduate Faculty are made by the chairperson of the graduate degree program or programs with which the faculty member will be concerned, and are acted upon by the Graduate School Executive Committee. An explanation of the criteria and guidelines for the membership policy which has been established by vote of the Graduate Faculty accompanies the nomination form, obtainable from the Graduate School Office, and is to be consulted by both the nominee and the chairperson before they complete the form. No candidate for a degree at WVU may be named to the Graduate Faculty.

Members and Associate Members are entitled to the same voting privileges and to participate fully in the proceedings of the Graduate Faculty. The only difference between the two statuses is that Associate Members are authorized to direct master's thesis research but not doctoral research. The status of Associate Member is indicated in the listing of the Graduate Faculty (Part 7 of this Catalog) by an asterisk (*) after the name.

The Executive Committee consists of the Dean of the Graduate School, ex officio, and nine Graduate Faculty members elected at large by the Graduate Faculty for staggered terms of three years. No more than one member may be elected from any one school or college. The Executive Committee normally meets once a month and calls meetings of the Graduate Faculty twice during the academic year.

In practice, much of the day-to-day administration of graduate study is conducted by the chairpersons or graduate advisers responsible for the particular programs. At the University level, responsibility for administering the graduate faculty's policies and regulations, resolving problems of interpretation of these rules, keeping student records, and preparing graduation lists is vested in the Dean of the Graduate School.

Academic Information

Graduate Adviser

Each academic unit through which graduate degree programs are administered has one or more graduate advisers, and each entering graduate student is assigned an adviser at the time of admission or shortly thereafter. The adviser and student should meet before the first enrollment to begin formulation of a plan of study.

Contractual Nature of Graduate Study

Graduate study at WVU can be compared to a series of contractual arrangements between the student and the graduate faculty of the University. The student's rights, privileges, obligations, and responsibilities are contained in these. These documents are the *Graduate School Catalog*, the plan of study, and, if research is one of the degree program requirements, the prospectus. Although not contracts in the formal legal sense, they are binding agreements between the University and a student for the accomplishment of planned educational goals.

Graduate Catalog

The *Graduate Catalog* (1974-75 to 1977-78) or *Graduate School Catalog* (to 1973-74, and from 1978-80) which is in effect when a student begins work toward an advanced degree constitutes an agreement between the student and the Graduate School of WVU. Acceptance by the University and enrollment on the part of the student signify the willingness of each party to abide by all the conditions stated in the *Catalog*.

If there are major changes in the *Catalog* during the course of a student's studies, the student does not have to abide by them unless they are promulgated by the Board of Regents or by local, state, or federal law. However, by choice and with the approval of adviser, committee (if appointed), and Graduate School, a student may make a "change in *Catalog*" and agree to meet all the conditions of the *Catalog* of a later year.

Application and Admission to Graduate Programs

No one is admitted to the Graduate School who does not hold a bachelor's degree from an accredited institution.

Students wishing to take off-campus courses (see page 34) for graduate credit must first be admitted to the Graduate School through the same procedures as for on-campus study, as specified in the material which follows.

Application

Prospective graduate students are urged to initiate application for admission as early as possible, January being none too early for admission the following fall semester. The first step of a student interested in a degree program should be to ask for information from the department, division, school, or college offering the program desired; the reply to such an inquiry will include instructions for applying to the particular program.

In all cases, application must be made for admission to the Graduate School, on standard forms provided by the Office of Admissions and Records. The completed form is to be returned to the Office of Admissions and Records, not to the Graduate School office, and must be accompanied, on first application, by payment of a nonrefundable special service fee of \$15.00. Applicants must at the same time request the registrar or records office of the college of their baccalaureate degree to send an official transcript directly to the Office of Admissions and Records. If other institutions have been attended in the course of undergraduate or graduate study, transcripts should be requested from them as well. Application and transcripts should be received at least one month before General Registration.

The \$15.00 service fee is required only once. In the case of any subsequent application for admission to the WVU Graduate School there is no service fee.

The occasional student who enrolls for a second bachelor's degree is not under the jurisdiction of the Graduate School but rather under that of the school or college which offers the baccalaureate degree program. Any student with a bachelor's degree who wishes to be given graduate credit for any course numbered 200 or higher must have been admitted to the Graduate School *before* enrollment in the course or courses concerned, making application as indicated above.

Reapplication

A student who has completed one graduate degree must reapply for admission to the Graduate School before taking additional course work. There is, however, no application fee the second time. This requirement exists to insure correct identification of new program interests and proper advising. Even non-degree students must reapply.

Kinds of Application

Degree Program

Applicants usually apply for admission to a degree program simultaneously with admission to the Graduate School. If the applicant meets the minimum ad-

mission requirements of the Graduate School, a copy of the application is forwarded to the faculty of the program of interest. Any graduate degree program is permitted to set admission requirements which go beyond the minimum admission standards of the Graduate School. No one can pursue an advanced degree at WVU unless admitted to the appropriate degree program.

Special Student

Some applicants wish to take graduate course work but not to pursue an advanced degree. Others may meet admission requirements but be uncertain about the program which would best suit their career goals. Such students are advised to seek admission as Special Students. To insure proper advising, all applicants for special admission are interviewed by the Graduate School. However, if time or distance makes such an interview impractical, it may be replaced by a letter detailing the applicant's academic background and experiences, career goals, and expectations for graduate study.

Classification on Admission to Graduate School

The Office of Admissions and Records will notify the applicant of the actions taken. A completed admission is in one of four categories:

1. *Regular Graduate Student* — one who is approved for a degree program.
2. *Regular with Deficiencies* — one who is approved for a degree program but has certain deficiencies to be made up by course work.
3. *Special Graduate Student* — one who would qualify for Regular status but is not pursuing a degree program.
4. *Special-Provisional* — one who because of undergraduate record or late application cannot be immediately approved for a degree program or the *Special* category.

Admission Based on Undergraduate Performance

To be classified as a *Regular Graduate Student*, the applicant must have had an undergraduate grade-point average of at least 2.5 (A equals 4.0), have been accepted into a graduate degree program according to the criteria established for that program, and be under no requirement to make up course deficiencies; the program must have received the applicant's records and have named an adviser.

The applicant is classified as *Regular with Deficiencies* if all the above conditions have been met except that there are course deficiencies to be made up.

To be a *Special Graduate Student* the applicant must also have an undergraduate grade-point average of at least 2.5; this is then the class for students who have not entered a degree program.

The applicant is classified as a *Special-Provisional Graduate Student* (1) when the application for admission has not been supported by official transcripts at the time of registration and/or (2) when, although a graduate of an accredited institution, the applicant presents an undergraduate grade-point average of less than 2.5. In the latter case, the student is admitted on probation, and must attain good standing in the first enrollment period, or, if a part-time graduate student, in the first 9 hours of course work. (See Probation and Suspension.)

Admission Based on Prior Graduate Study

The same four categories apply as well to those who have undertaken previous graduate study. In general, the cumulative grade-point average regulations apply to any transfer student who has not completed a graduate degree. However, an applicant having received a master's degree from an accredited college or university may be admitted to whatever category is deemed most appropriate by the faculty of the program of interest.

Reclassification of Status

A student, particularly one with a *Special* or *Special-Provisional* status, may later seek reclassification. Reclassification can be gained as follows:

1. From *Special-Provisional*

The *Special-Provisional* is a transitional category which permits the Graduate School to admit provisionally an applicant who does not satisfy the admission requirements at time of registration; admission materials may not yet have been received and processed, and/or the student's recent records show promise that appears to offset poor academic performance earlier. A student in the *Special-Provisional* category is required to seek reclassification by the time 9 to 12 semester hours of course work have been completed.

- a. To *Special* category.

This reclassification is possible if all entrance procedures have been completed and all other conditions of *Special* status have been met; i.e., the undergraduate grade-point average was at least 2.5; or if not, any special conditions stated in the letter of admission have been met and/or the student has maintained a cumulative grade-point average of at least 2.75 in graduate course work taken at WVU.

This reclassification can be initiated by the student at the Graduate School Office.

- b. To *Regular* (degree program) categories.

This reclassification is possible if the conditions for admission as a *Regular* student (either category) are met and/or a cumulative grade-point average of at least 2.75 has been maintained in graduate course work taken at WVU.

2. From *Special* to *Regular*

Students who had not originally intended to seek a graduate degree often change their minds after experiencing the stimulation of graduate course work. Reclassification is possible if the minimum graduate grade-point average of 2.75 has been maintained and the other conditions of the appropriate graduate program are met. The course work of special graduate students will not subsequently count toward a degree unless it is approved by the department in question.

For any reclassification to *Regular* status there must be the approval and the petition of the graduate faculty of the program admitting the student.

Petitions by Seniors for Graduate Credit

West Virginia University students (and those in colleges where WVU offers off-campus course work) who are within 12 semester hours of graduation may petition the Graduate School to be allowed to enroll for courses for which they may receive graduate credit after obtaining the baccalaureate and being admitted to the Graduate School. Such students must have a grade-point average of at least 2.5. Furthermore, the course work may not be counted for both undergraduate and graduate credit, and the petition must have been approved before or at the time of enrollment. The petition form is entitled "West Virginia Senior Petition for Graduate Credit."

The maximum amount of graduate credit permitted under this regulation is 15 hours. Combined graduate and undergraduate credit must not exceed 18 hours in one semester or 12 hours in the summer.

Petition forms for this purpose may be obtained at the Graduate School Office.

Special Admission Requirements of Some Programs

Programs may establish admission requirements in addition to those set by the Graduate School, such as the submission of scores on standardized tests, and the receipt of letters of recommendation.

Graduate Record and Other Examinations

Many programs at WVU require Graduate Record Examination (GRE) scores from all applicants, but in no program are they the sole criterion for admission. Some programs require both the general aptitude and the appropriate advanced test before considering an applicant for admission. Other programs require different tests, such as the Miller's Analogy. The admission requirements for each program are found in Part 4 of this *Catalog*.

Students should arrange to take the tests required for their prospective graduate majors before enrollment in the Graduate School. If GRE tests are required, the applicant should request the Educational Testing Service to forward scores to the WVU program concerned.

Those planning to take the GRE must mail completed forms so they reach the Educational Testing Service, Princeton, NJ 08540, at least eighteen days before the date of the examination. The forms and examination dates are a part of the GRE information packet available at the WVU Graduate School office or at other college centers throughout the country. The fee for each of the examinations (aptitude and advanced) is, for 1980-81 (as this goes to press), \$20.00.

Information about the Miller's Analogy test may be obtained from the psychology department of the applicant's undergraduate institution.

Admission of Foreign Students

This school is authorized under Federal law to enroll nonimmigrant alien students.

Foreign students wishing to enroll in the WVU Graduate School must comply with the academic requirements for admission which have already been

stated and with certain additional academic and non-academic requirements as follows.

Early Inquiry and Application

Foreign applicants should forward a letter of inquiry one year before the intended time of beginning study in the United States. Foreign students admitted are expected on campus at the beginning of July for a six-week period of orientation and intensive study of English. Accordingly, all the papers on which admission is based must have been received at the University at the very latest by April first, to allow sufficient time for their processing and the communication of the decision to the student, as well as for the student to make arrangements for passport and visa clearance and other necessary details.

Foreign students should make all arrangements for their financial obligations to WVU for their entire stay in the United States before leaving their country. A statement of WVU's requirements regarding these arrangements and regarding date of arrival on campus will be sent to those foreign students who are admitted.

English Proficiency

No person should undertake study at WVU who is not competent in the use of English. All foreign applicants the language of whose family and schooling was other than English must present a composite score of at least 550 on the "Test of English As a Foreign Language" (TOEFL). Some graduate degree programs require a considerably higher score on this test. Information on locations of TOEFL testing centers, dates of testing, and application forms is available from the Educational Testing Service, Princeton, NJ 08540, USA. Tests are normally given four times each year. It usually requires about one month to score and report individual test results. Registration for the TOEFL examination closes five weeks before the testing date.

With certain exceptions, entering foreign students are required to enroll at the end of June for the summer orientation program for foreign students. For those who prove to need it this program provides intensive instruction in written and spoken English. Others are enabled to begin study in their own program while profiting from the other features of foreign student orientation.

Credentials

Complete and original official records of all studies undertaken by an applicant at any institution attended (secondary school, college, university, technical school, professional school, etc.), must be provided at time of application for admission to WVU. Records may be copies, provided they are officially stamped. The records must show evidence of the study the applicant has done in the field of intended study at WVU.

Such records should include: (1) complete dates of attendance; (2) identification of individual subjects; (3) total number of hours in each class per week; (4) total number of weeks each class has in session; (5) final grade in each subject, for each year; (6) actual credits earned for each subject; (7) class, division or rank achieved; (8) identification of individual; (9) description and clarification of each institution grading system; and (10) certification, and date, of

degree or awards achieved, if not a part of the mark sheet or transcript. If any of this information cannot be supplied, an official explanatory statement from the school should be submitted. (All documents must be in English.)

All documents should be forwarded directly from the Registrar or other authorized official of the school to the WVU Office of Admissions and Records.

If an applicant is currently enrolled in a school, tentative admission may be granted on the basis of an incomplete record which indicates the applicant will unquestionably meet the admission standards of WVU. Final admission, however, cannot be approved until the complete record has been received and evaluated.

Foreign Students Transferring Within the U.S.

Foreign students applying to transfer from schools within the United States are advised that they will not be admitted and permitted to register at WVU unless they have complied well in advance with all requirements of the United States Immigration and Naturalization Service (INS).

The school the student was last authorized to attend must have completed and signed the INS form I-538. This, together with a valid I-20 form received from WVU must have been submitted to the INS office having jurisdiction over the school the student was last authorized to attend. If the student is not now attending that school, a letter must be added explaining in detail why.

If the INS approves the transfer, this approval will be stamped on the student's I-94. The student must then immediately notify WVU that the transfer has been approved, either by sending an INS statement of transfer approval, or simply by reporting the fact that the approval appears on the I-94.

Only when these procedures have been completed will WVU undertake to admit and register the student. No student should move to Morgantown without having received this assurance of admission from WVU.

Plan of Study

Shortly after entrance into a degree program and usually before 9 to 12 hours of graduate course work have been completed, a meeting is held among student, adviser, and committee (if appointed) to draw up a plan of study. Depending on degree sought and field of study, the plan may also contain the outline of the research problem to be undertaken. Some graduate programs have student and committee meet at a later date to delineate the research project more formally as a prospectus for the report, thesis, or dissertation.

The plan of study is subject to approval by the Dean of the Graduate School and is made a part of the student's record. It then becomes a formal agreement between student and program faculty as to the conditions which must be met for completion of the degree requirements. Any subsequent changes in plan of study (or prospectus) can be made only through mutual agreement and with Graduate School approval.

When the binding nature of these documents is fully understood, there is less likelihood that later misunderstanding will arise. Thus anyone who contemplates application to the Graduate School at WVU is urged to read this *Catalog* carefully and request clarification where needed. A student must be very aware of the right to express personal views in the drafting of the plan of study and/or research prospectus. Should disagreement arise at any time, the respon-

sibility for arbitration rests with the Graduate School Appeals Committee and the Graduate Dean.

Candidacy

Admission to candidacy for any graduate degree is an additional requirement over and above admission to the Graduate School and admission to a graduate program in a particular department, school, or college. A candidate for a graduate degree is a student who has been officially admitted to the Graduate School and to a graduate program and has satisfactorily completed a suitable period of graduate work in residence as a regular graduate student in which ability to do work of graduate caliber is demonstrated to the satisfaction of the student's adviser and graduate committee. In doctoral programs and in some master's programs it is established by successful completion of departmental qualifying, comprehensive and/or candidacy examinations as further explained in the following pages under requirements for the doctor's degree, and in Part 4 of this *Catalog*.

Scholarship

Grading

Because of their familiarity to most students, letter grades are assigned in many graduate courses. However, better than "average" performance is expected of graduate students. They are enrolled for fewer credit hours than they were as undergraduates, 9 to 12 hours being the norm for a full-time graduate student, and are expected to spend more time on each course and achieve better than average mastery of the material. A few grades of C can be tolerated in graduate programs provided there are higher grades in other courses to compensate for them. However, a grade of C is considered average performance for an undergraduate student and not for one who is studying for an advanced degree.

- A — excellent (given only to students of superior ability and attainment)
- B — good (given only to students who are well above average, but not in the highest group)
- C — fair (average for undergraduate students)
- D — poor but passing (cannot be counted for graduate degree credit)
- F — failure
- I — incomplete
- W — withdrawal before the date specified in the University Calendar for the semester or session of the student's enrollment in the course, or withdrawal doing satisfactory work thereafter
- WU — withdrawal (doing satisfactory work after the specified date)
- P — pass (cannot be counted for graduate degree credit — see below)
- X — auditor (no grade and no credit)
- S — satisfactory
- U — unsatisfactory (equivalent to D or F)

Pass/Fail grading is not applicable to the course work for a graduate degree. A graduate student may register for any course (1-499) on a Pass/Fail

basis only if the course involved is not included in the student's plan of study and does not count toward a graduate degree. The selection of a course for Pass/Fail grading must be made at registration and may not be changed after the close of the registration period. A student who, having taken a course on a Pass/Fail basis, later decides to include the course as part of a degree program must re-register for the course on a graded (A, B, C, D, or F) basis.

Credit Limitations

General

Credit toward a graduate degree may be obtained only for courses listed in the *Graduate School Catalog*, and numbered 200-499, in which the grade earned is A, B, C, or S. No courses in which the grade earned is D, P, F, or U can be counted toward a graduate degree.

Certain graduate-level courses are designated to be graded S (Satisfactory) or U (Unsatisfactory), a designation which has been approved for the specific course by the Dean of the Graduate School and applies to all students in the course.

No residence credit will be allowed for special field assignments or other work taken off the WVU campus without prior approval by the Dean of the Graduate School. No more than 40 percent of course credits counted toward meeting requirements of any graduate degree may be at the 200 level.

Maximum Course Load

No more than 15 hours of graduate courses in any one semester may be carried by a student. During the summer no more than 12 credits may be earned in the total of the two summer enrollment periods.

Transfer Credit

The Graduate School requirement for the master's degree at WVU consists of earning no fewer than 30 hours of graduate credit including at least 18 hours taken at WVU. For programs which require more than 30 hours, 60 percent of the course work is expected to be of WVU origin. Graduate courses taken elsewhere will not be approved for transfer credit unless the written approval of the Dean of the Graduate School was secured before enrolling in them. Such transfer credit, to be approved, must meet requirements for a continuous and unified program of graduate study.

Employed Graduate Students

Graduate students will be required by their advisers to limit their credit loads in proportion to the outside service rendered and the time available for graduate study. In general, persons in full-time service to the University, or other employer, will be advised to enroll for no more than 6 hours of work in any one semester and those in half-time service for no more than 12 hours. Maximum credit loads may be less for employed graduate students in some academic colleges, schools, and departments.

Maximum Time for Completion

Completion of requirements for any graduate degree must be accomplished within a period of seven years or within three years of passing a written com-

prehensive examination covering *all* of the course work and competencies outlined in the plan of study. In the case of a doctoral degree, when there is an intervening award of a master's degree, the seven-year limit for completion of the doctorate starts at the initial enrollment for a graduate course after the master's degree is conferred. Credits lost at the beginning of a graduate program under this regulation will not usually be considered for revalidation and then only upon formal petition to the Dean of the Graduate School by the student's graduate adviser or committee chairperson, showing a completion program which the student must meet.

Grade-Point Average

The grade-point average is computed on all work for which the student has registered while in the Graduate School except for courses with grades of I, S, W, WU, P, and X, and is based on the following grade-point values:

A	B	C	D	F	U
4	3	2	1	0	0

When a student receives a grade of I and later removes the incomplete grade, the grade-point average is then recalculated on the basis of the new grade.

The grade of I is given when the instructor believes the course work is unavoidably incomplete or that a supplementary examination is justifiable. The grade of I must be removed before any graduate degree can be awarded, either by removal of the incomplete or by having it recorded as a *permanent incomplete*. Only the instructor who recorded the I, or, if the instructor is no longer at WVU, the chairperson of the unit in which the course was given, may initiate either of these actions.

In the case of withdrawal from the University, any I grade remains on the student's record as I.

Probation and Suspension

Probation. A *Regular* (degree program) graduate student whose grade-point average falls below 2.75 after the first 9 hours of graduate study is not in good standing and will be placed on probation. A *Special* graduate student is not in good standing and will be placed on probation if a 2.25 average is not maintained after a similar period of enrollment. A student on probation is required to achieve a cumulative graduate grade-point average of 2.75 by the time he/she has completed the next 9 hours of graduate course work at West Virginia University (or in the case of the part-time graduate student, in the next 9 hours of graduate course work). A *Special-Provisional* graduate student whose undergraduate grade-point average was less than 2.5 is, by definition, on probation when admitted, and must achieve a grade-point average of 2.75 in each semester of *Special-Provisional* status (or, if a part-time graduate student, in the first 9 hours of graduate course work) to be in good standing. If having done so, this student is reclassified to *Special* status, the requirement for good standing becomes that of maintaining at least a 2.25 grade-point average.

Suspension. If the required average is not attained, the student will be suspended; that is, will not be allowed to continue in the Graduate School. Additionally, a student failing one-half or more of the course work taken during any enrollment period will be suspended.

The above are minimum standards for the entire Graduate School; a graduate program may set higher standards which the student must also meet.

A student who has not been properly admitted or who has been suspended from a program may not further enroll. If registration of course work is attempted, the University can cancel the enrollment.

Credit hours for courses in which the grade is lower than C will not count toward satisfying graduate degree requirements.

Ethics of Scholarship

Students enrolled in the Graduate School are expected, like the faculty, to adhere to the methods of rigorous scholarship and to the ethics which characterize sound scholarship. It is particularly grave for a graduate student to transgress the ethics of scholarship, since the student's presumed purposes in Graduate School are to master aspects of the method and content of a discipline and to prepare for a professional role.

The term plagiarism is an important one in all scholarly endeavor, and needs to be clearly understood by all scholars. It is plagiarism to steal and pass off as one's own the ideas or words of another; it is therefore plagiarism to present as one's own an idea derived from an existing source. These are the straightforward definitions provided by *Webster's Seventh New Collegiate Dictionary*. A student under some doubt as to whether a particular instance might constitute plagiarism should request the help and clarification of the faculty member under whom the work is being done.

The Graduate School's policy and procedural rules for handling cases of alleged plagiarism or other cheating offenses are designed to provide due process and protect students from miscarriage of justice, and to protect the University community from the degrading effects of unpunished dishonesty in academic work.

Procedural Rules for Handling Cheating/Plagiarism

The West Virginia University policy on cheating is contained in the *WVU Student Handbook*.

Because a university is recognized as a community of scholars, activity on the part of a student which is disruptive and contrary to the goals of an academic community need not be endured. Consequently the faculty of a graduate program may recommend to the President of the University the removal of a student from its rolls whenever, by formal decision reduced to writing, the faculty finds that the student's actions infringe on the rights of others to an orderly learning environment.

Absences

Students and faculty have together formulated the University's policy on absences from classes, which spells out the responsibilities of student and instructor as follows:

The student who is absent from class for any reason is responsible for work missed. Students should understand that absences may jeopardize their grades or continuance in the course. Instructors who use absence records in the determination of grades must announce this fact to students (in writing) within the first five class meetings. It is the responsibility of the instructor to keep an accurate record of all students enrolled. Instructors may report excessive absences to the student's dean or adviser. Students who have been absent

because of illness, authorized University activities, or for other valid reasons, are to have the opportunity to make up regularly scheduled examinations.

As a matter of good manners, a student should inform an instructor in advance if obliged to be absent from a class meeting.

Withdrawals

Withdrawals are of two sorts: withdrawal from some part of the work for which registered, and withdrawal from the University. Unless the formal withdrawal procedures are completed, failing grades are recorded. All withdrawals must have the initial approval of the student's adviser. It is the student's responsibility to see that all forms are properly executed and delivered to the appropriate authorities for recording.

Withdrawal from Class

Deadlines: Until the Friday of the tenth week of class (or Friday of fourth week in six-week summer session, or Friday of second week of three-week summer session), students registered on either a full-time or part-time basis may withdraw from individual courses. Deadlines will be published in the WVU *Schedule of Courses* each semester. *No withdrawal* from individual courses will be permitted *after* the published deadline each semester or summer session.

Procedure:

1. Students must obtain adviser signature on the University course adjustment form and submit the completed form to the Office of Admissions and Records to complete the process.
2. Before completing the form, however, students with adviser assistance are responsible for determining:
 - a. whether their course load would be reduced below the minimum requirement set by their program; or
 - b. whether their course load would be reduced below the minimum number of hours required to qualify for financial aid, or international full-time student status; or
 - c. whether the courses to be dropped are required to fulfill academic probationary conditions; and/or
 - d. whether the courses to be dropped are corequisite or prerequisite to another course the student is taking or a prerequisite to a course required the following term. (If so, students may be required also to drop the corequisite course, or asked to consider withdrawal from a substitute course in order to avoid delays in meeting degree requirements.)
3. Students who withdraw from courses following all of the established University procedures before the published deadline shall receive a W on the transcript for the appropriate course(s). The grade-point average is not affected in any way by this mark.

Withdrawal from the University

1. Students who decide to leave WVU should withdraw from all classes and must do so in accordance with established University policy in order that the official transcript reflects this action.

2. Students are responsible for all *financial obligations* and for following established procedures, including the completion of forms and delivery of the completed forms to appropriate officials. The withdrawal becomes official only after the forms have been recorded by the Dean of Admissions and Records. Students will receive copies and are urged to keep them.

Deadlines: Any student (full- or part-time) may withdraw from all classes for which he/she is registered in the University *any time before the last day* on which regular classes are scheduled to meet as established for the University Calendar and published in the *Schedule of Courses* for the semester or summer session in question.

Procedure:

1. Students who desire to withdraw from all remaining classes should report in person to the Division of Student Affairs offices at the main lobby information desk of Moore Hall. Withdrawal procedures will be explained at that time.
2. Students who are unable to withdraw in person because of illness, accident, or other valid reason still must notify the Division of Student Affairs of their intention to withdraw. The notice should be verified in writing.
3. Students are responsible with the help of their academic advisers for determining how withdrawal from the University may affect their future status at the University, including such aspects as suspension for failure to make progress toward a degree or a violation of established academic probation; and, eligibility for scholarship, fellowship, or financial aid.

Off-Campus Graduate Study

The Center for Extension and Continuing Education conducts five WVU graduate centers located at Jackson's Mill, Parkersburg, Potomac State College, Shepherd College, and West Liberty State College. Under the administration of the Division Leader for Off-Campus Credit Programs, approximately 130 graduate-level off-campus courses are offered each semester and are designed to enable students to fulfill the requirements of specified master's degree programs.

Master's programs available through the centers are reading, secondary classroom teacher, education administration, elementary classroom teacher, business administration, and safety studies. Courses offered are approved by the appropriate department chairperson and academic dean, by the Division Leader, and by the Dean of the Graduate School.

Students wishing to take off-campus courses for graduate credit must first be admitted to the Graduate School through the same procedures as for on-campus study, as specified under "Application and Admission." It is the responsibility of students to ascertain from the appropriate college and department the specific requirements for degree candidacy.

Advising and scholarship standards are the same for on-campus and off-campus study.

Library Resources

Library and laboratory facilities for off-campus courses must be approved by the Division Leader for Off-Campus Credit Programs and, in case of courses

for graduate credit, by the Graduate School Dean. Books for use by off-campus students may be borrowed from the WVU Library upon the order of the Division Leader for Off-Campus Credit Programs, subject to the approval of the Library Committee. Postal charges must be paid by the individual or groups for whom the books are borrowed.

Full-Time and Part-Time Students

A student is classified as either full-time or part-time in any given enrollment period. In the Graduate School a student is classified as full-time if enrolled for as many as 9 hours in a semester or as many as 6 hours altogether in the summer.

Registration Requirements

Students Using Any University Facilities — Even if the graduate student does not wish to enroll in course work but is simply making use of University library and research facilities, consulting with graduate committee members, or anticipating final examination, it is necessary to have such student enrolled for at least 1 hour of graduate credit. In no other way can the University receive credit for its contribution to graduate study, attest to student status, or guarantee the protection to which the student is entitled. A student may not take the final examination or complete other conditions for graduation unless duly enrolled.

Graduate Program Continuance Fee — In order to maintain admission and good standing as a regular or special graduate student, each student must complete at least one course in at least one enrollment period a year or pay a program continuance fee of \$35.00 during one of any three consecutive enrollment periods. Approved leave of absence may be granted by the Graduate Dean, in cases of extreme need, military service, or other just cause, for a stated period of time normally not to exceed one calendar year. Failure to maintain continuous enrollment by this means will be interpreted as withdrawal from the Graduate School. Regular admission procedures must be followed by students wishing to be considered for readmission.

Graduation When Not in Residence — A minimal registration fee of \$1.00 is payable by the student who is to graduate while not in residence, provided such student has complied with the provision for continuance in program. If a student not in residence and not making use of any University facilities is to return simply to take the final examination for a degree, the adviser should address a letter to the Graduate Dean, explaining these facts and asking that for this student, who must be registered in order to be graduated, all tuition and fees be waived except for the \$1.00 fee. If the request is approved by the Dean, it will be returned with the approval signature to the adviser, who will then see that it is presented at the Office of Admissions and Records by the student or by a member of the same department at least two weeks before the end of the semester in which the degree is to be awarded.

Theses and Dissertations: Procedural Rules

Theses and dissertations must be presented to the student's graduate adviser or committee chairperson at least one month for master's candidates and

two months for doctoral candidates before the end of the enrollment period in which completion of all requirements is expected. The form prescribed under the Graduate School "Regulations Governing the Preparation of Dissertations and Theses" must be followed with the guidance of the student's graduate adviser or the chairperson of the student's committee. For the manuscript to be approved there must be no more than one unfavorable vote among members of the student's committee. Two accepted copies in approved typewritten form (master's theses in bound form and doctoral dissertations unbound) must be delivered to the Graduate School office at least one week before the close of the period in which the degree is expected to be completed (one week before the end of the second summer session, one week before the end of the final examination period at the end of the first semester, or one week before Commencement Day at the end of the second semester). Additional regulations are described under specific degree requirements in the following pages, and in the "Information and Check List for Master's Candidates," a corresponding leaflet for doctoral candidates, and one for the adviser or committee chairperson, available at the Graduate School office. Problem reports are deposited with the major department in the form and by the dates the department requires.

The WVU Office of Publications provides service to graduate students in the preparation of multiple copies of master's theses and doctoral dissertations. Following are some of the guidelines concerning the services offered:

1. Students must furnish a neatly typewritten manuscript of the text with all pages numbered and collated in conformity with the regulations of the Graduate School. The use of carbon ribbons on typewriters will produce neater copies of the thesis.

2. The Office of Publications usually cannot reproduce oversize scores, maps, charts, or other illustrations larger than page size but it will give advice to students concerning the presentation of these materials and furnish names of businesses that can handle the work.

3. The typed manuscript pages must be delivered to Room 113, Communications Building; to the Medical Center Copy Center; to the Knapp Hall Copy Center; or to the Allen Hall Copy Center.

4. Charges will be the published rates which may be obtained at the copy centers.

5. Normal lead time for completion of the work is three weeks. Students who desire faster service are referred to duplicating shops that may be able to provide it.

6. Delivery cannot be made except upon payment in full by cash.

7. Phone numbers to use in making special inquiry concerning this service are 293-6366 (Communications Building); 293-5069 (Medical Center Basic Sciences Building); 293-3467 (Allen Hall); or 293-2040 (Knapp Hall).

Final Examinations

The final examination is not to be given until the semester or summer session in which all other requirements for the degree are to be met. In programs requiring a thesis, or dissertation, the final examination must follow committee approval of the manuscript. The student's adviser or committee chairperson must notify the Graduate School office in advance of the time, place, and recommended examining committee membership and receive clearance in the form of the student's "shuttle sheet" (copy of the student's record in Graduate School)

before the examination can be given. Such notifications of doctoral examinations must be received in the Graduate School office at least three weeks before the examination date. All doctoral final oral examinations are open examinations and the lead time is required for public notice to the University community. Examining committees must be comprised of no fewer than three members for the master's degree and no fewer than five members for the doctor's degree. The chairperson and the majority of master's degree committee membership must be members or associate members of the Graduate Faculty. It is customary to name to the committee one person from a department other than that of the student's major field.

For doctoral programs both the dissertation and final examination chairpersons must be members (full) of the Graduate Faculty, as must the majority of the committee members. Every doctoral committee must include at least one person from a department other than that of the major field of the doctoral program. The student cannot be considered as having satisfactorily passed the final examination if there is more than one unfavorable vote among members of the examining committee. Results of each examination must be reported to the Graduate School office by return of the shuttle sheet within 24 hours of the scheduled time regardless of whether the examination was actually held. Re-examination may not be scheduled without approval of the Dean of the Graduate School. No examination is to be given without the required number of committee members present: three for a master's, five for a doctoral examination. Additional requirements for research doctorates include acceptance by the Graduate School office of the dissertation bearing original signatures of at least all but one of the committee members. As with the final examination, if more than one member of the committee (whatever the size of the committee of at least five) dissents from approving the dissertation, the degree cannot be recommended.

Request for Degree

At the time of registration for the enrollment period in which all degree requirements are expected to be met, or at the latest within two weeks after such registration,* each candidate is to submit a formal request to the Dean of the Graduate School for the conferring of the degree; this is done on a special "Application for Graduation and Diploma" form (obtainable from the adviser or the Graduate School office). The candidate must complete all requirements at least one week before the end of that enrollment period. If the degree is not actually earned during that term, the student must submit a new "Application for Graduation and Diploma" when registering for the term in which completion is again anticipated.

Commencement, Diplomas

Attendance at the spring Commencement is voluntary. Anyone not planning to attend should leave a complete mailing address with the Graduate School office so that the diploma can be mailed.

*The student must be registered in the enrollment period of graduation. See special provision for the student not in residence, page 35, "Registration Requirements," paragraph 3.



Part 3

GRADUATE DEGREES

The Master's Degree

General Requirements and Information

General. Regulations governing admission, registration, scholarship, etc., described in the preceding sections must be followed. These are also summarized in the "Information and Check List for Masters Candidates" available at the Graduate School office.

Program. At least 30 hours of graduate work planned with the student's graduate adviser must be satisfactorily completed within the period of seven years immediately preceding the conferring of the degree. The program must be formulated in writing at the earliest possible date and a copy filed with the Graduate School office so as to result in a cohesive, unified, and continuous plan of study. Most plans of study consist of certain amounts of work in major and minor fields. These are described in the departmental programs in Part 4 of the *Graduate School Catalog*. In degree programs requiring a thesis or problem report, appropriate course credits may be taken to cover the research and writing, but no more than 6 hours of credit earned for research or thesis may be counted in meeting course requirements for the degree.

Special. Each student, through consultation with a graduate adviser, must meet the special requirements of the faculty of the field of major study, subject to approval of the Dean of the Graduate School.

Second Master's Degree

When there is academic justification for a second master's degree, the Graduate School is to be petitioned for approval.

Summary of Procedures for Master's Degrees

1. Letter of inquiry from prospective student to department chairperson (program inquiries) or to Graduate School (general-information inquiries).
2. Mailing of Graduate School application form to student from the Office of Admissions and Records.
3. Receipt of application materials and required fee by the Office of Admissions and Records.
4. Referral of application materials to appropriate program by the Office of Admissions and Records.
5. The department in question notifies Admissions and Records of the admission action.
6. Admissions and Records reports the student's admission status to the Graduate School, which reviews the admission action. Admissions and Records notifies the student of his/her academic status.

7. The student arrives, reports to the program department, is assigned an adviser, and registers for course work.

8. Shortly after admission to the program (usually within the first 9-12 semester hours of course work), an advisory committee is formed and produces the student's plan of study, a copy of which is filed with the Graduate School Office.

9. Student completes requisite course work and other program requirements.

10. Student confers with adviser and, if applicable, chairperson of thesis committee to see if all requirements can be met by the end of the semester in which he/she plans to graduate. This should be done *no later than the beginning of the final semester*.

11. Student registers for either a course or for the oral examination (fee \$1.00). No one may graduate who is not registered as a student during the semester preceding graduation.

12. Student checks with the Graduate School office to insure that there is correspondence between departmental and Graduate School records and that there are no remaining deficiencies.

13. Student completes an "Application for Graduation and Diploma," available from the adviser or from the Graduate School office. This should be done *no later than two weeks after registration*.

14. Student pays the \$10.00 Diploma Fee. After getting a fee slip from the Office of Admissions and Records, the student pays the fee at the Cashier's window of the Controller's Office in the Mountainlair.

15. (If applicable) The student presents a typed draft of the thesis to each committee member.

16. The student should remind the committee chairperson to request a shuttle sheet from the Graduate School *at least two weeks prior to the date of the final examination (or thesis defense)*.

17. Results of the final examination (or thesis defense) must be reported on the shuttle sheet by the graduate adviser or committee chairperson to the Graduate School not later than one week prior to the end of the semester or summer session in which the degree is expected to be granted.

18. Two bound and signed copies of the thesis, the original and first copy, or two electrostatically reproduced copies, must be submitted to the Graduate School no later than one week before the last day of the student's final semester.

Degrees

Fields or departments in which these degrees are offered are as follows:

Master of Arts (M.A.) with a major in:

Art
Counseling and Guidance
Economics
Education Administration
Educational Psychology
Elementary Education
English
Foreign Languages
History

Political Science
Psychology
Reading
Secondary Education
Sociology and Anthropology
Special Education
Speech Communication
Theatre

Master of Science (M.S.) with a major in:

Agricultural Biochemistry	Mathematics
Agricultural Economics	Medical Technology
Agricultural Education	Microbiology (Medical)
Agricultural Microbiology	Mineral and Energy Resources
Agronomy	Orthodontics
Anatomy	Pharmaceutical Sciences
Animal Science	Pharmacology and Toxicology
Biochemistry (Medical)	Physical Education
Biology	Physics
Chemistry	Physiology (Medical)
Community Health Education	Plant Pathology
Computer Science	Recreation
Endodontics	Rehabilitation Counseling
Family Resources	Reproductive Physiology
Genetics and Developmental Biology	Safety Studies
Geology	Speech Pathology and Audiology
Horticulture	Statistics
Industrial Relations	Wildlife Management

Master of Science in the following designated fields:

Aerospace Engineering (M.S.A.E.)	Industrial Engineering (M.S.I.E.)
Chemical Engineering (M.S.Ch.E.)	Journalism (M.S.J.)
Civil Engineering (M.S.C.E.)	Mechanical Engineering (M.S.M.E.)
Electrical Engineering (M.S.E.E.)	Nursing (M.S.N.)
Engineering (M.S.E.)	Petroleum Engineering (M.S.Pet.E.)
Engineering of Mines (M.S.E.M.)	
Forestry (M.S.F.)	

Other designated Master's degrees:

Agriculture (M.Agr.)	Professional Accountancy (M.P.A.)
Business Administration (M.B.A.)	Public Administration (M.P.A.)
Fine Arts (visual) (M.F.A.)	Social Work (M.S.W.)
Music (M.M.)	

Doctor of Philosophy Degrees

General Requirements and Information

Regulations governing admission, registration, scholarship, etc., described in the preceding sections must be followed. Students applying for admission to a doctoral program after having received a master's degree at WVU must file a new completed form for admission to the Graduate School with the Office of Admissions and Records. This is to insure intent and proper records and does not entail an additional application fee.

The student must satisfy such special requirements, approved by the Graduate Dean, as may be required by the faculty responsible for the major field.

All of the requirements for any graduate degree must be completed within a period of seven years.

Candidacy Requirements

Admission to the Graduate School and enrollment in graduate courses does not of itself imply acceptance of the student as a candidate for a Ph.D. degree. This is only accomplished by (1) satisfactorily passing a comprehensive preliminary or qualifying examination (either oral, or written, or both) and (2) by meeting specified language and/or other requirements.

(1) *Qualifying Examination.* After a period of residence a student will be given a comprehensive examination in order to demonstrate whether a grasp has been attained of the important phases and problems of the field of major study, their relation to other fields of human knowledge and accomplishments, and the ability to employ rationally the instruments of research in the major field. The scheduling and results of each such examination must be reported to the Graduate School office.

(2) *Foreign Language Examinations.* Competence in one or more foreign languages is a common requirement in graduate degree programs. The Graduate School does not set the foreign language requirement, but instead looks to the faculty in the graduate degree program to specify the language or languages and the level of competence to be demonstrated.

Language examinations are arranged by the Graduate School's foreign language examiner, who can be contacted through the Department of Foreign Languages or the Graduate School office, and under whose direction language examinations are administered. Information on the form of the examination and its scheduling is available to advisers and students from the Graduate School office.

When only reading competence is required, the foreign language examiner may waive examination in cases where the student's transcript shows, at a date that proves to fall no earlier than seven years before promotion to candidacy for the doctorate, either

- (a) completion of 12 semester hours or equivalent of course work in an approved foreign language, at WVU or at any other institution of recognized standing, with a grade of B or better in the last three hours, or
- (b) completion of French 306, German 306, or Russian 306 at WVU with a grade of B or better.

Advisers should request from the Graduate School Office the announcements regarding foreign language reading requirements and examinations, and the registration form for the examination, in order to be able to inform their students and follow established procedures.

Candidacy for the Ph.D. is granted when a student is certified as having satisfied the language requirement and has successfully completed the qualifying examination.

Program

The program of Ph.D. study is planned with the student's graduate adviser and committee to combine any or all of the following: Graduate courses of instruction, special seminars, independent study, supervised research, and supervised training designed to promote a broad and systematic knowledge of the

major field and to prepare the student for the comprehensive qualifying and final examinations and writing of the dissertation.

Residence

Graduate education, especially at the doctoral level, involves many learning experiences which take place outside the formal classroom setting. These involve observing and participating in activities conducted by the graduate faculty, using departmental and University libraries, attending lectures presented by visiting scholars, informal debates with fellow students, and similar activities.

To insure that their graduate students experience these kinds of informal learning, Ph.D. programs at WVU as elsewhere generally require three years in residence in full-time graduate study. However, because of the contractual nature of graduate study, an individual student or graduate committee may propose an alternative plan by which the student can gain equivalent educational experience. For example, the plan of study may require the student to spend time in residence at a national or foreign laboratory, institute, archive, or research center as partial fulfillment of the residency requirement.

Dissertation

The candidate must submit a dissertation pursued under the direction of the faculty of the University on some topic in the field of the major subject. The dissertation must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. While conducting research or writing a dissertation the student must register at the beginning of each semester or summer during which credit is being earned. No residence credit will be allowed for special field assignments or other work taken off the University campus without prior approval by the Dean of the Graduate School.

Final Examination

If the candidate's dissertation has been tentatively approved and all other requirements have been met, upon proof of current registration and approval of the Dean of the Graduate School, the final oral examination on the dissertation can be scheduled. At the option of the faculty responsible for the degree program, a comprehensive final written examination also may be required. Results of the examination must be reported to the Graduate School office within twenty-four hours. These results, as well as acceptance of the dissertation, and certification of its suitability for immediate publication, must be reported by the committee chairperson to the Graduate School office not later than one week before the end of the semester or summer in which the degree is expected to be granted (one week before the end of the summer, one week before the end of the final examination period of the end of the first semester, or one week before Commencement Day at the end of the second semester).

Publication of Dissertations

All Ph.D. and other doctoral dissertations and their abstracts will be micro-filmed through University Microfilms, Ann Arbor, Michigan. This requirement will not be satisfied by any other publication but does not preclude publication elsewhere, which is both permitted and encouraged.

Candidates are to follow "Regulations Governing the Preparation of Dissertations and Thesis" regarding format and organization of the dissertation, which is on file at the Graduate School office, department offices, offices of all graduate advisers, and the University libraries. The candidate must also request of the Graduate Dean the newly revised information on copyrights. The candidate is required to maintain close contact with the supervisor or chairperson of the graduate committee on these matters in developing a dissertation so as to incorporate the special requirements of the subject discipline.

One week before the close of the semester or summer in which the degree is expected to be conferred the candidate must meet the following requirements as well as others described in the "Information and Check List for Doctoral Candidates" obtainable at the Graduate School office:

1. Submit to the Graduate School office, in form satisfactory for microfilming, the typewritten, unbound original and first carbon copy of the dissertation both signed by the candidate's committee. Two excellent machine-reproduced copies may be acceptable if approved in sample in advance and if final copies conform.

2. Submit to the Graduate School office one abstract as above of the dissertation consisting of no more than 600 words.

3. Submit to the Graduate School office a microfilm contract completed and signed by the candidate.

4. Pay a fee of \$30.00 at the Graduate School office to cover the cost of microfilming the dissertation and publication of the abstract in *Dissertation Abstracts*, a bi-monthly journal which receives wide distribution. This fee is payable by certified check made out to "West Virginia University." If desired, copyright service can be provided through the Graduate School office upon receipt, along with the dissertation, of a certified check for \$20.00 made payable to "University Microfilms."

5. Complete the questionnaire entitled "Survey of Earned Doctorates" obtained at the Graduate School office and return it there.

Major Fields

Programs toward the Ph.D. are offered in the following major fields:

Agricultural Biochemistry
Agricultural Microbiology
Agronomy
Anatomy
Animal Nutrition
Biochemistry (Medical)
Biology
Biomedical Sciences
Chemistry
Economics
Engineering
English
Forest Resources Science

Genetics and Developmental Biology
Geology
History
Microbiology (Medical)
Music
Pharmaceutical Sciences
Pharmacology and Toxicology
Physics
Physiology (Medical)
Plant Pathology
Political Science
Psychology
Reproductive Physiology

Summary of Procedures for the Doctoral Degree

1. Letter of inquiry from prospective student to department chairperson (program inquiries) or to Graduate School (general-information inquiries).

2. Mailing of Graduate School application form to student from the Office of Admissions and Records.
3. Receipt of application materials and required fee by the Office of Admissions and Records.
4. Referral of application materials to appropriate program by the Office of Admissions and Records.
5. The program in question notifies Admissions and Records of the admission action.
6. Admissions and Records reports the student's admission status to the Graduate School, which reviews the admission action. Admissions and Records notifies the student of his/her academic status.
7. The student arrives, reports to the program department, is assigned an adviser, and registers for course work.
8. Shortly after admission to the program (usually within the first 9-12 semester hours of course work), an advisory committee is formed and produces the student's plan of study, *a copy of which is filed with the Graduate School Office.*
9. Student completes requisite course work and other program requirements, satisfying also the stipulated residency requirement. (See page 43.)
10. Student takes the language examination (if applicable).
11. Student takes written and/or oral comprehensive (qualifying) examination for admission to candidacy. The results are communicated to the Graduate School office by the student's graduate program adviser.
12. Student undertakes a doctoral dissertation under the guidance of a dissertation committee. The dissertation phase begins with approval of a dissertation prospectus by the dissertation committee, the department chairperson, the college dean and the Dean of the Graduate School.
13. The dissertation adviser (committee chairperson) requests a shuttle sheet from the Graduate School *no later than 3 weeks before the oral examination.*
14. A copy of the preliminary draft of the dissertation is given to each committee member at least two weeks prior to the final oral examination.
15. The time and place of the examination is announced.
16. The student defends the dissertation in an oral defense.
17. The student complies with rules for the publication of dissertations.

Special Additional Requirements and Information

College of Business and Economics

The College of Business and Economics offers graduate programs in accountancy, business administration, economics, and industrial relations.

The program in accountancy leads to a degree of Master of Professional Accounting (M.P.A.) The program is supervised by the graduate faculty in accounting. The students are administered by the director of graduate studies in business.

The program in business leads to the degree of Master of Business Administration (M.B.A.). All the requirements for the program are offered at the Morgantown campus, as well as at the West Virginia University graduate centers in Parkersburg and West Liberty. The M.B.A. program is supervised by the graduate faculty in business administration. The students are administered by the director of graduate programs in business.

Graduate programs in economics lead to the degrees of Master of Arts (M.A.) and Doctor of Philosophy (Ph.D.). These programs are supervised by the graduate faculty in economics. The students are administered by the director of graduate programs in economics. These programs also have a number of special options conducted jointly with other units on campus. These options include: agricultural economics, business analysis, energy economics, industrial relations, law and economics, management or marketing, manpower planning and evaluation, mathematical economics, political economy, and statistics and economics.

The program in industrial relations leads to the degree of Master of Science. This program is supervised by the graduate faculty in business and economics. The students are administered by the director of graduate programs in industrial relations.

All work for a graduate degree must be completed within a period of seven years. An extension of this period must be approved in writing by the appropriate graduate faculty and the Dean of the Graduate School.

Creative Arts Center

The Creative Arts Center offers graduate training in art, music, and theatre. All students apply for admission to the Graduate School through the Office of Admissions and Records. All candidates for graduate degrees must conform to the general regulations of the Graduate School. Requirements for admission to specific graduate programs are given in Part 4. Additional information may be obtained by writing to the division chairperson or the dean of the Creative Arts Center.

It is the responsibility of the student to be properly informed of the curriculum and degree requirements of the program in which the student is enrolled. The student's adviser or other appropriate members of the faculty will offer counseling regarding requirements upon request.

The Creative Arts Center reserves the right not to offer courses in the listed semester on the basis of low enrollment, change in curriculum, availability of faculty, or other reasons at the convenience of the Creative Arts Center.

Graduate Assistantships

Approximately eleven graduate assistantships in art, nine in theatre, and twenty-three in music are available each year. Full graduate assistants receive tuition remission and a stipend of \$2,412.

Applications for graduate assistantships should be made to the appropriate division by March 17 in music, March 1 in art, April 1 in theatre.

School of Dentistry

The School of Dentistry offers several advanced education programs. The Departments of Endodontics and Orthodontics offer programs of advanced study leading to the degrees of Master of Science. Detailed information concerning the Master of Science programs in Endodontics and Orthodontics will be found in Part 4.

The Department of Oral Surgery offers one oral surgery internship and two residencies. Seven general practice residencies also are offered by the School of Dentistry. Continuing education courses are offered throughout the year. Information concerning admission requirements, courses of study, etc. in these programs may be obtained from the Office of the Associate Dean for Advanced Education Programs.

College of Engineering

A student desiring to take courses for graduate credit in the College of Engineering must comply with the appropriate regulations of the Graduate School. To become enrolled in a College of Engineering graduate program, a student must apply for admission through the Office of Admissions and Records to the major department of the student's choice. Acceptance by the major department will depend upon review of the student's academic background and available facilities in the department.

An applicant with a baccalaureate degree, or its equivalent, from a department accredited by the Accreditation Board for Engineering and Technology (ABET) will be admitted on the same basis as engineering graduates of WVU. Lacking these qualifications, an applicant must first fulfill any special requirements of the department in which the student is seeking an advanced degree.

No credits which are reported with a grade lower than C are acceptable toward an advanced degree.

To qualify for an advanced degree, the graduate student must have a grade-point average of at least 3.0 based on all courses acceptable for graduate credit for which the student has received a grade from WVU.

A graduate student in the College of Engineering must comply with the regulations of the major department and with the requirements as stated in the "Guide to the Graduate Program in Engineering."

Master of Science

Each department in the College of Engineering has a designated M.S. degree and the College of Engineering has an undesignated degree, Master of Science in Engineering. For all M.S. degrees each candidate will, with the approval of the candidate's Advisory and Examining Committee, follow a planned program which must contain a minimum of 30 semester credit hours, not more than 12 of which can be at the 200 level. If a thesis or a problem report is part of the candidate's program, not more than 6 semester credit hours of research leading to an acceptable thesis nor more than 3 semester credit hours of work for an acceptable problem report may be applied toward the semester credit hour requirement.

Individual departments may establish minimum requirements greater than those adopted for the College of Engineering as a whole. These departmental requirements are contained in Part 4 of the Graduate School Catalog.

The Master of Science in Engineering program is designed for students having a baccalaureate degree in a technical area who desire to pursue work in areas other than that of their baccalaureate degree in engineering or science.

Graduate students who wish to become candidates for the degree should register with the department in which the major portion of the work is to be done.

Admission to candidacy for an M.S. degree is required before obtaining that degree. A graduate student may apply for admission to candidacy by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0, based on all graduate courses — taken in residence — for which the student has received a grade at the time of application.

Doctor of Philosophy

The College of Engineering has an interdisciplinary program leading to the degree of Doctor of Philosophy (Ph.D.). The academic units approved for participation in this program are: Aerospace Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering and Mechanics, plus several units within the College of Mineral and Energy Resources.

Admission. Admission to the Graduate School is required of all applicants for admission to a program of study and research leading to the Ph.D. degree. Applicants for admission are expected to have successfully completed a bachelor of science or master of science program in some phase of engineering equivalent to the programs leading to the degrees in effect at WVU. Admission to the Graduate School does not necessarily assure entrance into the College of Engineering Ph.D. program.

After the student has earned 24 to 36 graduate credit hours (or completed master's degree requirements), the student, with the advice and consent of his/her academic adviser, research director, and members of his/her Advisory and Examining Committee, will submit a plan of study to the College's Engineering Graduate Committee. A student becomes admitted to the college's interdisciplinary program upon formal approval of the plan of study.

Candidacy. After admission to the program and after a period of residence, the applicant takes a comprehensive preliminary or qualifying examination (written or oral) in which the student must demonstrate: (a) a grasp of the important phases and problems of the field of study and an appreciation of their relation to other fields of human knowledge and accomplishments; and (b) the ability to employ rationally the instruments of research developed in the major and minor fields. When an applicant has successfully passed the comprehensive examination the student will be formally admitted to candidacy for the doctoral degree.

Curriculum. The Doctor of Philosophy degree is not awarded for the mere accumulation of course credits nor for the completion of a definite residence requirement. The amount and nature of the course work undertaken by the candidate will be established for each individual candidate with the object of insuring a rational and coherent progression of academic development beyond the baccalaureate degree. However, to attain the educational objectives of the College's interdisciplinary program, each program of study must contain at least one of the following:

- a. One 12-hour minor in a department of engineering or in any area other than the candidate's major department provided the candidate's program in-

cludes at least 6 hours of engineering courses outside the candidate's major department, or

b. One 6-hour minor of engineering courses outside the candidate's major department and a second 6-hour minor in any area outside the candidate's major department, suitable to the student's educational objective.

(As used above, an "area" should form a logically coherent set of courses which complement the student's educational objectives. The courses may be taken from one or more University units if these courses constitute such a coherent set.)

In addition, minors in areas other than engineering are encouraged to broaden the candidate's knowledge and the appreciation of human accomplishments.

Residence. It normally takes at least three years of full-time graduate study to satisfy the requirements for the degree of Doctor of Philosophy. This must include a minimum of two semesters of residence in full-time graduate study at WVU.

Dissertation. The candidate must submit a dissertation on a topic within the area of the student's major interest. The doctoral dissertation must represent the results of independent research, show a high degree of originality and creativity on the part of the student, and must constitute an original contribution to the field of engineering science and/or design. The dissertation must have good literary form and style; and must present a thorough review and survey of prior study and work in the area of research, with acceptable standards of documentation. It is anticipated that the work leading to the completion of the dissertation will require a minimum of 24 hours of research and/or dissertation credits, or satisfactory evidence of equivalent time devoted to research and preparation of the dissertation.

Final Examination. Upon completion and approval of the dissertation and fulfillment of all other requirements, the candidate must pass a final oral examination conducted by an Advisory and Examining Committee of at least five members recommended by the major department and appointed by the Dean of the Graduate School. The examination will be primarily a defense of the dissertation, although other questions necessary to determine the candidate's logic, critical ability, and reasoning power in the general field of study related to the research may be in order to establish the qualifications of the candidate for the degree.

Doctor of Education

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. The sequence of prerequisites to admission, prerequisites to candidacy, and requirements for the degree are set forth in the College of Human Resources and Education section of the *Graduate School Catalog*. The requirements for the degree of Doctor of Education for students in Engineering are identical with those for students in Education.

College of Human Resources and Education

The College of Human Resources and Education includes the departmental program and service areas of Counseling and Guidance, Curriculum and Instruction, Education Administration, Educational Psychology, Family Resources, Health Education, Reading, Rehabilitation, Special Education, Speech Pathology

and Audiology, and Technology Education. The college brings together several disciplines devoted to the study and maximum development of human talent and resources, whether in the context of the school, the family, or the community. Programs of instruction, research, and extended service are carried out in close cooperation with other related departments and divisions of WVU.

Admission and Curriculums

All students apply for admission to the Graduate School through the Office of Admissions and Records. All candidates for graduate degrees must conform to the general regulations of the Graduate School and specific requirements of the College of Human Resources and Education and of the program area involved. Certain details in regard to admission to specific graduate programs of the College of Human Resources and Education are provided under the program section. Additional information may be obtained by writing the department chairperson in which the graduate program is offered, or by writing the Dean of the College of Human Resources and Education.

The curriculum and degree requirements of the various master's degree programs of the College of Human Resources and Education are provided in each program section in this catalog. It is the responsibility of the student to take steps to insure being properly informed of the requirements of the degree toward which the student aspires and/or the certification standards to which the student may wish to conform. Since certification requirements are changed from time to time by the state, the contents of this catalog do not guarantee compliance with those requirements. Members of the faculty and the student's adviser will offer counsel on these matters upon request.

Doctor of Education

The degree of Doctor of Education (Ed.D.) is a competency-based program. The student's adviser, the student's committee and the student in consultation determine the competencies the student must attain and how they are to be evaluated. The degree requires that the candidate demonstrate an ability to conduct research. Faculty expertise and College of Human Resources and Education support services are available for students desiring to elect an area of emphasis in any of the following: counseling and guidance and rehabilitation counseling, curriculum and instruction, education administration, engineering education, health education, physical education, reading, safety studies, special education, educational psychology, speech pathology and audiology, and technology education. Applicants may pursue the Doctor of Education degree while emphasizing curriculum and teaching in their specific academic area. Examples of such areas of interest are foreign language education, English education, mathematics education, science education, engineering education, theater education, music education, physical education, and social studies education. Other cooperative and special programs are possible with approval of the department chairperson.

Admission. Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School. All applicants for admission to the doctoral program in the College of Human Resources and Education must submit scores on the aptitude test of the Graduate Record Examination, the Miller Analogies Test, three letters of recommendation, a current vitae, a statement of long-range and short-range goals, the reason for selecting

WVU as the institution for matriculation, and comply with the general regulations of the Graduate School. Personal interviews are required by several programs. Additional material may be required by the faculty of a department and/or a specific area of emphasis prior to program admission.

Doctoral Committee. Having received an affirmative recommendation for admission to a specific program, the student, in consultation with the adviser, recommends a chairperson and four committee members as the student's doctoral committee. This committee must be approved by the chairperson of the department, the Dean of the College, and the Dean of the Graduate School. At least one member of the doctoral committee must come from the supporting discipline and no more than three from any single program area of the College of Human Resources and Education. At least three members of the committee must hold full membership status on the graduate faculty. The committee chairperson must be one of these full members.

Curriculum. The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of relevant graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 hours from a major area of concentration in a supporting or related discipline.

Admission to Candidacy Examination. The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the doctoral degree.

The student and the committee at the time of program planning will include competencies to be developed and how they will be assessed. These will be written into the student's program. The doctoral student and the permanent committee will determine when the student is ready for assessment of competencies.

The examination will be prepared and assessed by the student's doctoral committee. The chairperson will notify the student and the student records office, who will notify all appropriate offices of the outcome. Upon successful completion of the admission to candidacy examination, and the acceptance by the committee of the dissertation prospectus, the student will be admitted to formal candidacy for the doctoral degree.

Dissertation. The candidate must submit and justify a prospectus for a doctoral dissertation as a portion of the admission to candidacy examination. The doctoral committee must review and *approve*, *approve with change*, or *reject* the outline or prospectus. The student shall consult with all members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phase of the program.

Final Oral Examination. The student will be admitted to final oral examination upon completion of the dissertation and after fulfilling all other requirements set by the committee. The examination will be conducted by the student's doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if the student receives more than one unfavorable vote from the doctoral committee.

Time Limitation. All requirements must be completed within seven years. The seven-year limit commences with the initial enrollment for a graduate course after the master's degree is conferred.

Residency. The minimum is two consecutive semesters of residence in full-time graduate study at WVU (summer sessions not included).

Certificate of Advanced Study (C.A.S.)

This program is designed to prepare school and related personnel who wish professional training beyond the master's degree. Candidates for the Certificate of Advanced Study in Education may choose from among the following areas of study for their area(s) of concentration: (a) Administration and Supervision; (b) Curriculum and Instruction; (c) Counseling and Guidance; (d) Reading; (e) Special Education; (f) Physical Education, and (g) Safety Studies. Persons interested in the certificate should consult with the chairperson of the appropriate department or the Dean of the College of Human Resources and Education.

Admission. Individuals who wish to pursue a program leading to the certificate must be admitted to the Graduate School. All applicants for admission to the program in the College of Human Resources and Education must submit scores on the aptitude test of the Graduate Record Examination, the Miller Analogies Test, three letters of recommendation, and comply with the general regulations of the Graduate School. Acceptance for study toward the certificate in a specific area of concentration will be made by the faculty of the specific program and department.

Requirements for Admission to Candidacy. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral and written communication. Satisfactory completion in residence at WVU of at least 6 semester hours of approved course work beyond conferral of the master's degree.

Program. An approved program consisting of a minimum of 30 semester hours earned above the master's degree including 24 hours of course work in the College of Human Resources and Education, or in closely related fields, and 6 hours of research.

At least 24 semester hours of the work credited for this certificate must be done in residence at WVU. This includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairperson of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in WVU off-campus education, may, if approved by the student's adviser, be allowed toward credit for the certificate. The minimum period of full-time graduate study in residence at WVU is one semester or one full summer session.

Final Examination(s). Upon completion of all requirements, including the research report, the candidate will be admitted to a final oral examination by the student's graduate committee.

Time Limitation. All requirements must be completed within seven years immediately preceding the awarding of the certificate.

Master of Arts (M.A.); Master of Science (M.S.)

The Master of Arts degree is offered in those areas which lend themselves to a broader based education; generally a wider choice of electives is offered. Programs offered in this area are: Counseling and Guidance; Education Administration; Educational Psychology; Elementary Education; Reading; Secondary Education; and Special Education.

Various areas of emphasis are available under several of the degree programs listed above. Contact the specific department for information.

The Master of Science degree is offered in those areas which are more specialized and specific areas of electives are defined. Programs offered in this area are: Community Health; Family Resources; Rehabilitation Counseling; and Speech Pathology and Audiology.

Various areas of emphasis are available under several of the degree programs listed above. Contact the specific department for information.

Admission Requirements

Graduate students apply to the University Office of Admissions and Records for admission. All applicants must comply with the admission requirements of the Graduate School, the College of Human Resources and Education, and the specific program of interest.

Students may be admitted as degree candidates on submission of an undergraduate grade-point average of 2.5. These students may pursue the program of their choice immediately on *Regular Graduate Student Status*.

Students who do not meet the admission requirements and have a grade-point average of less than 2.5 will be classified as *Special-Provisional* and may take a maximum of 12 semester hours of course work. At the end of this period students may apply to the respective department for review of their admissions classification. Reclassification will be considered only in cases in which the student has achieved a minimum grade-point average of 3.0 for the first 12 semester hours of graduate study. All work taken up to the conclusion of the semester in which the twelfth semester hour is earned will be used in computing the grade-point average. If the student is not reclassified to degree program status by the department, the student is not eligible to continue graduate study leading to a degree in the specified program. The student may, upon petition in writing to the department chairperson, be permitted to take additional course work in that department for the renewal of the teaching certificate.

Optional Routes

Three options are generally available; refer to the specific program to determine which option applies.

A. Thirty semesters hours of course work, including 6 semester hours of research.

B. Thirty semester hours of course work, including 3 semester hours of research, selected in conference with the candidate's committee, directed by the adviser, with final approval by the committee and 27 semester hours of course work.

C. Thirty-six semester hours of approved course work.

Program Requirements

1. *Guidelines* — Specific requirements of the Graduate School, the College of Human Resources and Education, and the program being followed will be complied with.

2. *Advising* — All students will be assigned an adviser who will guide the student in course selection and program progress. Two additional faculty members will be assigned to serve as the remainder of the three-member master's committee.

3. *Grade-Point Average* — No student may be awarded a master's degree unless the student has a minimum grade-point average of 3.0 on all work taken for graduate credit. (A grade of less than C does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

4. *Course Repeats* — No student will be permitted to repeat a required graduate course more than once.

5. *Transfer Credit* — The maximum number of hours which may be used from transfer credit is 12 (30 hr. program), or 14 (36 hr. program). Credit for transfer must be of graduate level from an accredited college or university offering a graduate degree. Only credit of B or higher will be transferred.

6. *Comprehensive Examination* — Many programs require the comprehensive examination in options A, B, and C above. The candidate's committee will determine whether the examination will be oral, written, or both. Students must submit an application to take the final master's degree examination within the first week of the semester or two weeks of the semester in which they intend to take it. A student must have completed a minimum of 27 semester hours of approved course work before taking the comprehensive examination. In addition a student must have a 3.0 grade-point average on all work taken for graduate credit before *applying* to take the comprehensive examination.

A candidate who fails the final master's degree examination may, upon written consent of the student's advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination and desires a third opportunity to complete program requirements may meet at the committee's discretion to determine remediation recommendation before the third and final trial at the examination. The third examination may be given no earlier than one calendar year from the second examination. If the student fails the third comprehensive examination, that student will be removed from the degree program.

7. *Program Termination* — Students who fail to meet the specifics of the sections dealing with admission, grade-point average, course repeats, transfer credits, comprehensive examinations, or special requirements, spelled out in writing by a specific program, will not be admitted to or will be terminated from the degree program. Students not admitted to or terminated from a degree program may apply in writing through the department chairperson or the Office of Student Advising and Records of the College of Human Resources and Education to be classified as a "Special Graduate Student" (non-degree). This would allow the student to take course work for certificate renewal, certification, or personal interest, but not applicable for a degree in the department.

Curriculum and Instruction

The Department of Curriculum and Instruction, in cooperation with other departments, offers graduate programs leading to the degree of Master of Arts, Certificate of Advanced Studies, and Doctor of Education. In addition, professional preparation is available for certification in those specific areas where state certification is required. The major emphasis in all programs is curriculum and teaching with an academic area, teaching area, or area of interest serving as the supporting area. Optional tracks in specific subject and program areas, including Education Foundations, are available. Areas of emphasis for the Master of Arts degree in Elementary and Secondary Education include Adult and Continuing Education, Early Childhood Education, Higher Education Curriculum and Teaching, Human Services, Librarian-Media Specialist, and Technology Education.

Interdisciplinary Studies Options (M.A., Ed.D.)

Interdisciplinary studies options offer unusual opportunities for the discerning student to obtain an advanced degree custom designed to individual need and aspirations. Interdisciplinary options in the College of Human Resources and Education are composed of several fields of study which assemble and integrate specialized knowledge and competencies in light of a career focus. Individualized options are characterized by a high degree of flexibility in their composition, by the need for critical judgment, by the opportunity for a practical experience application, and by extensive student participation in program planning.

An interdisciplinary studies option leading to the degree of Master of Arts (M.A.) or Doctor of Education (Ed.D.) is distinguished by the clear articulation of a dominant theme, a central organizing axis for the formulation of a personal course of study. Such options require the integration and possible modification of the concepts of the disciplines as they are brought to bear on the dominant theme. Each student identifies a personal unifying degree theme, but examples around which themes might be developed include educational environments, education and politics, juvenile drug abuse, educational policy, instructional systems, human services, educational media, institutional unionism, technology in society, education and social goals, organizational dynamics, education and government, or a host of others.

For admission information related to interdisciplinary programs, contact: Committee on Admissions, Graduate Executive Committee — Education, 802 Allen Hall.

Technology Education

The Department of Technology Education offers areas of emphasis leading to degrees of Master of Arts (M.A.), Certificate of Advanced Study (C.A.S.) and Doctor of Education (Ed.D.). Areas of emphasis include Communication, Production, and Transportation. Faculty and students in the program are committed to a continuing investigation of the impact of technology on people, society, and the environment. The goal of the program is an increased level of understanding about technical means so as to provide the basis for developing, controlling, directing, and redirecting technical systems for the benefit of humankind. This program is involved in the SREB Academic Common Market. Students from the southern region (ten southern states) should inquire about in-state tuition. Contact the Chairperson of Technology Education for detailed information.



Part 4

GRADUATE MAJOR PROGRAMS AND COURSES

Plan for Numbering Courses

For convenience, each course of study is designated by the name of the department in which it is given and by the number of that course. The plan for numbering is as follows:

Courses 200 to 299 — Courses for advanced undergraduate students and selected graduate students. No more than 40 percent of the credits counted for meeting requirements for a graduate degree can be at the 200 level.

Courses 300 to 399 — Courses for graduate students; students in professional programs leading to the doctorate; and selected, advanced undergraduates. Undergraduates in any class carrying a 300-level course number should have a 3.0 cumulative grade-point average and have written approval on special forms from their instructors and advisers and the Graduate School Dean. Seniors within 12 semester hours of graduation may, with prior approval on special senior petition forms of their advisers and Graduate School Dean, enroll in 300-level graduate courses. (In summary, 200-level courses are intended primarily to serve undergraduate students; 300-level courses are intended primarily to serve introductory graduate and master's degree course needs.)

Courses 400 to 499 — Courses for graduate students only. All doctor's degree dissertation hours shall be awarded at the 400 level — specifically under course number 497.

Graduate degree credit hour requirements must include at least 60 percent at the 400 and 300 level.

Abbreviations in Course Listings

- I — a course given in the first semester
- II — a course given in the second semester
- I, II — a course given in each semester
- I and II — a course given throughout the year
- Yr. — a course continued through two semesters
- S. — a course given in the summer
- hr. — credit hours per course
- lec. — lecture period
- rec. — recitation period
- lab. — laboratory period
- Conc. — concurrent registration required
- PR — prerequisite
- consent — consent of instructor required
- CR — credit but no grade

Schedule of Courses

Before the opening of each semester and summer sessions, a *Schedule of Courses* is printed announcing the courses that will be offered by the colleges and schools of WVU. *Courses in this Catalog are subject to change without notice.*

AEROSPACE ENGINEERING

Jerome B. Fanucci, *Chairperson of the Department*
G-70 Engineering Sciences Building

Degrees Offered: M.S.A.E., M.S.E., Ph.D.

Graduate Faculty: Members Fanucci, Loth, Ness, Squire, and Walters. Associate Member Palmer.

Graduate programs in the Department of Aerospace Engineering of the College of Engineering are designed to allow the student to attain more detailed knowledge than is possible in an undergraduate curriculum. While a degree of specialization is required in order to understand complex areas of study, programs are formulated to include related subjects, including appropriate basic mathematical tools. The attainment of knowledge in a graduate program allows the student to pursue a wide range of employment opportunities with industry, government, and in educational institutions. Higher level positions in areas such as design and research often require graduates with advanced degrees.

The graduate faculty has developed a variety of courses and facilities to allow meaningful graduate study and research in many areas of Aerospace Engineering. Areas of research in recent years include V/STOL and low-speed aerodynamics, solar and wind energy, combustion, magnetohydrodynamics, and the fluid mechanics of fluidized beds and coal mine ventilation. Funded research has increased significantly each year, which allows the department to acquire needed up-to-date research equipment and facilities. Laboratories include such equipment as subsonic and supersonic wind tunnels, shock tubes, combustion test equipment, a solar collector test facility, wind turbine test facilities, a structures and vibration laboratory, and well-instrumented V/STOL and Cessna U-206 flight test aircraft. Extensive instrumentation and computer-controlled data acquisition systems are used in all laboratories, and complete shop facilities for test item fabrication are available.

The faculty of the department has accumulated over fifty years of professional industrial experience, and over one-hundred years of teaching experience, a combination which aids in determining relevant course material and research topics. The faculty also has published over 400 articles, reports, and books in its field. Such experience helps the graduate student select a beneficial program of study and research.

Master of Science in Aerospace Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Aerospace Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the Department of Aerospace Engineering.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of a planned program.

Final Examination. Each candidate for the master's degree shall pass a final examination administered by the student's Advisory and Examining Committee.

Courses. The following grouping of courses is given as a guide for selecting a graduate program leading to the degree of Master of Science in Aerospace Engineering:

Group I. Required of all candidates. Six semester credit hours of advanced mathematics beyond a first course in differential equations.

Group II. Major. Minimum of 9 semester hours of aerospace engineering courses, other than A.E. 497, in the 200, 300, and 400 series.

In order to meet the minimum requirements for the degree of Master of Science in Aerospace Engineering, additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee: (1) Courses from Groups I and II; (2) Aerospace engineering courses in the 200 series which are not required for the degree of Bachelor of Science in Aerospace Engineering; (3) Physics and chemistry courses in the 200 and 400 series; and (4) Courses in other departments of the College of Engineering in the 200 to 400 series.

Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, may be required to attain a proficiency in each of the following areas: (1) fluid mechanics, (2) thermodynamics, and (3) applied mathematics.

Research work for the doctoral dissertation must constitute an original contribution to the field of aerospace engineering.

Aerospace Engineering (A.E.)

- 215. *Experimental Fluid Dynamics II.* 3 hr. PR: A.E. 115. Continuation of A.E. 115 with increased emphasis on dynamic measurements. Shock tube/tunnel and subsonic and supersonic measurements. Experiments include optical techniques, heat transfer to models, and viscous flow measurements. Error analysis of test data. 2 hr. lec., 3 hr. lab.
- 216. *Applied Aerodynamics.* 3 hr. PR: A.E. 140. Chordwise and spanwise airload distribution for plain wings, wings with aerodynamic and geometric twist, wings with deflected flaps, and wings with ailerons deflected. Section induced drag characteristics. 3 hr. lec.
- 220. *Guided Missile Systems.* 3 hr. PR: A.E. 112 and/or Conc.: A.E. 150. Design philosophy according to mission requirements. Preliminary configuration and design concepts. Aerodynamic effects on missiles during launch and flight. Ballistic missile trajectories. Stability determination by analog simulation. Performance determination by digital and analog simulation. Control, guidance, and propulsion systems. Operational and reliability considerations. 3 hr. lec.
- 232. *V/STOL Aerodynamics.* 3 hr. PR: A.E. 112. Fundamental aerodynamics of V/STOL aircraft. Topics include propeller and rotor theory, helicopter performance, jet flaps, ducted fans and propeller-wing combinations. 3 hr. lec.
- 234. *Fluid Dynamics III.* 3 hr. PR: A.E. 112. Fundamentals of viscous flow and the Navier-Stokes equation; incompressible laminar flow in tubes and boundary layers; transition from laminar to turbulent flow; incompressible turbulent flow in tubes and boundary layers. 3 hr. lec.

235. *Fluid Dynamics IV*. 3 hr. PR: A.E. 112. One-dimensional, non-steady gas dynamics. Shock tube theory and applications. Fundamentals of supersonic and hypersonic flow and the determination of minimum drag bodies. 3 hr. lec.
242. *Flight Testing*. 3 hr. PR: A.E. 140. Applied flight test techniques and instrumentation, calibration methods, determination of static performance characteristics, and introduction to stability and control testing based on flight test of Cessna Super Skywagon airplane. Flight test data analysis and report preparation. 1 hr. lec., 6 hr. lab.
249. *Space Mechanics*. 3 hr. PR: Math. 18, M.E.M. 42. Flight in and beyond the earth's atmosphere by space vehicles. Laws of Kepler and Orbital theory. Energy requirements for satellite and interplanetary travel. Exit from and entry into an atmosphere. 3 hr. lec.
250. *Advanced Topics in Propulsion*. 3 hr. PR: A.E. 150 or consent. Special problems of thermodynamics and dynamics of aircraft power plants. Chemical rocket propellants and combustion. Rocket thrust chambers and nozzle heat transfer. Nuclear rockets. Electrical rocket propulsion. 3 hr. lec.
260. *Design of Flight Structures I*. 3 hr. PR: A.E. 161. Structural design and analysis of flight vehicle members. Layout and detail design of specified components are required. 1 hr. lec., 6 hr. lab.
265. *Aeroelasticity*. 3 hr. PR: A.E. 160. Vibrating systems of single degree and multiple degrees of freedom, flutter theory and modes of vibration, torsional divergence, and control reversal. 3 hr. lec.
280. *Aerospace Problems*. 1-6 hr. Upper division and graduate.
285. *Thesis*. 2-6 hr. PR: Senior standing and consent.
291. *Introduction to Research*. 1-3 hr. PR: Senior standing and consent. Methods of organizing theoretical and experimental research. Formulation of problems, project planning, and research proposal preparation.
292. *Research Problems*. 2-6 hr. PR: A.E. 291 or consent. Performance of the research project as proposed in A.E. 291. Project results are given in written technical reports, with conclusions and recommendations.
300. *Seminar*. Credit. Attendance required of all graduate students at scheduled Aerospace Engineering seminars.
315. *Fluid Flow Measurements*. 3 hr. PR: A.E. 112 or consent. Principles and measurements of: static and dynamic pressures and temperatures, velocity and Mach number forces. Optical techniques and photography. Design of experiments. Review of selected papers from the literature. 2 hr. lec., 3 hr. lab.
380. *Special Problems*. 2-4 hr. PR: Consent of department chairman. For graduate students in the non-research program. The student will select a specialized field and follow a course of study in that field under the supervision of a counselor.
381. *Specialized Study Program*. 1-6 hr. PR: Consent. Discussion, individual study reports in aerospace engineering.
411. *Dynamics of Viscous Fluids*. 3 hr. PR: Consent. Exact solutions of the Navier-Stokes equations. Laminar incompressible and compressible boundary layer theory, similarity solutions and integral methods. 3 hr. lec.
412. *Fundamentals of Turbulent Flow*. 3 hr. PR: A.E. 411 or consent. Basic experimental data. Application of semi-empirical theories to pipe, jet and boundary layer flow. Turbulent heat and mass transfer. Statistical theory of turbulence and recent applications. 3 hr. lec.

413. *Dynamics of Real Gases*. 3 hr. PR: A.E. 411 or consent. Fundamentals of multicomponent, chemically reacting, gas flows; thermodynamic properties of equilibrium mixtures from statistical mechanics; chemical kinetics; effects of the chemical model on high-temperature, high-speed flow properties.
425. *Perfect Fluid Theory*. 3 hr. PR: Consent. Conformal mapping including Schwarz-Christoffel and Joukowski transformations. Inviscid flows over airfoils, spheres, cones, wedges, and bodies of revolution. 3 hr. lec.
435. *Gas Dynamics I*. 3 hr. PR: A.E. 112 or consent. Nonsteady gas dynamics and shock tube theory. Shock tubes in aerospace research. Compressible flow theory in subsonic, transonic, and supersonic regimes. 3 hr. lec.
436. *Gas Dynamics II*. 3 hr. PR: A.E. 435 or consent. Transonic flow-hodograph method, the Chaplygin-Karman-Tsin approximation. Hypersonic flow-bluntbody field theory. Shock wave and viscous interaction with flow fields, blastwave theory and similar solutions. 3 hr. lec.
440. *Advanced Flight Mechanics*. 3 hr. PR: A.E. 112, 140. Dynamic stability. Obtaining flight characteristics of the vehicle from dynamic flight test techniques such as frequency response, and transient response methods. Problems of automatic control. 3 hr. lec.
449. *Space Mechanics*. 3 hr. PR: Math. 245, A.E. 112, 150. Variational formulation of mechanics. Theory of orbits and trajectories with applications to astronomical problems. Introduction to the space environment. 3 hr. lec.
450. *Fundamentals of Combustion*. 3 hr. PR: A.E. 112 or consent. Kinetic theory, transport phenomena, chemical equilibrium and reaction kinetics. Flames, their gross properties, structure and gas dynamics. Solid and liquid propellant combustion. 3 hr. lec.
458. *Foundations of Magnetohydrodynamics I*. 3 hr. PR: Consent. Ionization in gas flows; equations of state, charge, mass, momentum, and energy conservation; effects of self-generated and external electric and magnetic fields on electrically conducting fluids and transport coefficients. 3 hr. lec.
459. *Applied Magnetohydrodynamics II*. 3 hr. PR: Consent. Incompressible and viscous MHD channel flow; plane waves in fluids, discontinuities and MHD shock waves; applications of MHD to electric power generation, etc. 3 hr. lec.
465. *Dynamics of Aerospace Structures I*. 3 hr. PR: A.E. 474 or consent. Free and forced vibrations of systems with finite and infinite degrees of freedom. Effect of rotary inertia and shear on lateral vibrations of beams. Hamilton principle and Lagrange equations in vibration problems. 3 hr. lec.
466. *Dynamics of Aerospace Structures II*. 3 hr. PR: A.E. 465. Two- and three-dimensional wing theory in incompressible and compressible flow. Wings and bodies in three-dimensional unsteady flow. 3 hr. lec.
474. *Advanced Aerospace Structures I*. 3 hr. PR: A.E. 161 or consent. Stress analysis; deflection of trusses and beams. Statically indeterminate problems. Hardy cross moment distribution and slope deflection methods. Matrix methods of structural analysis; force and displacement methods. 3 hr. lec.
475. *Advanced Aerospace Structures II*. 3 hr. PR: A.E. 474 or consent. Principles in structural analysis, beam-column, sandwich beams and plates. Methods of obtaining exact and approximate solutions (Rayleigh-Ritz, Galerkin, etc.). Buckling loads in compression. Stiffened panels, wrinkling in sandwich construction. Minimum weight design. Shells. 3 hr. lec.
497. *Research*. 1-15 hr.

(See Eng. 260 under General Engineering in Part 5.)

AGRICULTURAL BIOCHEMISTRY

William G. Martin, *Chairperson of the Interdivisional Committee*

1022 Agricultural Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Brooks, Hoover, Ingle, Kaczmarczyk, Martin, Reid, Stelzig, and Ulrich.

The Interdivisional Committee of Agricultural Biochemistry of the College of Agriculture and Forestry offers graduate studies leading to the degrees of Master of Science and Doctor of Philosophy. Each student will select and conduct research in the broad areas of biochemical genetics, nutritional biochemistry, or plant biochemistry. The research project selected by the student represents the base upon which the graduate program is built.

The objective of the agricultural biochemistry graduate program is to prepare the student for a career in biochemistry in agricultural and biological areas. Each student, in concert with the adviser and graduate committee, will design the student's and research program at the beginning of the first semester. The student and adviser then prepare the research proposal which, when approved by the graduate committee, will become the distinguishing feature of the program and when completed will provide the data for the thesis or dissertation.

In addition to the requirements for admission to the Graduate School, applicants for admission to the graduate degree programs in agricultural biochemistry must have an overall grade-point average of at least 2.5 in general, analytical, organic, and physical chemistry. Deficiencies in these courses may be removed during the first year of graduate enrollment if prior consent is obtained from the agricultural biochemistry faculty. Courses in biology and physiology are beneficial, though not required for admission.

Master of Science

The Master of Science (M.S.) degree in Agricultural Biochemistry combines the academic and research programs of the student yielding a biochemist prepared for a career in agricultural and biological sciences. The academic program is composed of graduate courses in agricultural biochemistry and selected minor courses in genetics, nutrition, or plant sciences. The student will be advised by a committee of three or more faculty. Thirty hours of graduate credit is required for the degree, of which no more than 6 may be for research. The research program terminates with a thesis which is presented to the graduate committee and defended in a comprehensive examination.

Doctor of Philosophy

The program for the degree of Doctor of Philosophy (Ph.D.) is a research-oriented, advanced-level study tailored to the interests of the motivated student. Indeed, this program offers the student the opportunity of original research, with course work providing the base from which this independent study is launched. The student, aided by graduate-student and faculty exchange in seminar, laboratory, and formal courses, becomes prepared for the candidacy examinations which are taken at the end of the first year.

The candidacy examinations are administered to the student by the student's graduate committee, usually five members, and are composed of a writ-

ten and oral part. The student will be given one written examination by each committee member during the first week, and upon the satisfactory completion of these, the oral examination will be administered during the following week.

Research is generally initiated during the first semester or when the committee and student feel appropriate for that individual. The student will begin the original research, in association with the adviser, which when completed will be presented to the committee as a Ph.D. dissertation. This work will be defended by the candidate in a final oral examination, given as a seminar open to the public and followed by the committee examination.

Agricultural Biochemistry (Ag. Bi.)

- 210. *Introductory Biochemistry*. I, II, S. 3 hr. PR: 8 hr. General chemistry, Chem. 131 or equiv. Introduction to the chemistry of cellular constituents (proteins, amino acids, carbohydrates, lipids, nucleic acids, enzymes and coenzymes) and their metabolism in animals and plants.
- 212. *Nutritional Biochemistry*. II. 3 hr. PR: Ag. Bi. 210 or consent. Nutritional biochemistry of domestic animals.
- 213. *Nutritional Biochemistry Laboratory*. II. 2 hr. PR: Ag. Bi. 210 or consent. A laboratory course to introduce the principles of biochemistry and to apply these to experiments with animal and plant systems.
- 310. *General Biochemistry*. I. 3 hr. PR: 8 hr. Organic chemistry. The first half of a general course of biochemistry designed for graduate students of biological sciences. The course emphasizes the chemical properties of cellular constituents.
- 311. *Laboratory Experiments in Biochemistry*. I. 2 hr. PR or Conc.: Ag. Bi. 310. Experiments designed to demonstrate some of the basic techniques and concepts of biochemistry.
- 312. *General Biochemistry*. II. 3 hr. PR: Ag. Bi. 310 or consent. The second half of a general course of biochemistry designed for graduate students of biological sciences. The course emphasizes reactions and control of intermediary metabolism.
- 314. *Radionuclide Biochemistry*. II. 3 hr. PR: Chem. 1, 2, 131, or consent. Radionuclide methods and isotope handling as needed by students interested in biological research. (Course will not be offered in 1981-82.)
- 318. *Amino Acid Biochemistry*. I. 2 hr. PR: Ag. Bi. 312 or consent. Properties, reactions, biosynthesis, and intermediary metabolism of amino acids in animals and plants.
- 410. *Biochemistry of Carbohydrates*. I. 3 hr. PR: Ag. Bi. 312 or consent. Chemical, biological, and metabolic aspects of sugars, polysaccharides, glycolipids and glycoproteins. (Offered in Fall of odd years.)
- 412. *Lipid Biochemistry*. II. 3 hr. PR: Ag. Bi. 312 or consent. The chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways. (Offered in Spring of even years.)
- 414. *Enzymes*. II. 3 hr. PR: Ag. Bi. 312 or consent. A survey of enzymology covering general principles as well as current concepts and methods.
- 415. *Advanced Biochemistry Laboratory*. II. 2 hr. PR or Conc.: Ag. Bi. 312. Experiments in the areas of intermediary metabolism and enzymology.
- 416. *Vitamins*. I. 2 hr. PR: Ag. Bi. 312 or consent. Identification, nomenclature and chemical structures, biochemical systems, biogenesis, pathology, and requirements of vitamins and vitamin-like compounds. (Offered in Fall of even years.)

418. *Mineral Metabolism*. II. 3 hr. PR: Ag. Bi. 312 or consent. Biochemistry and metabolism of minerals in the body and their role in nutrition and physiological function. (*Offered in Spring of odd years.*)
422. *Plant Biochemistry*. I. 3 hr. PR: Ag. Bi. 312 or consent. Advanced treatment of the composition and metabolism of plants. Topics covered include cell wall structure, sulfur and nitrogen metabolism, and photosynthesis. (*Offered in Fall of odd years.*)
450. *Seminar*. I, II. 1 hr. per sem.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigations of biochemistry in animal and plant systems. Study may be independent, with staff approval, or through specially scheduled lectures.
497. *Research*. I, II, S. 1-15 hr. Research in biochemical genetics, nutritional biochemistry or plant biochemistry under staff supervision for agricultural biochemistry majors.

AGRICULTURAL ECONOMICS

Dale K. Colyer, *Chairperson, Division of Resource Management*
Degree Offered: M.S.

Graduate Faculty: Members Barr, Colyer, Jack, McIntosh, Nelson, Nesselroad, and Smith.
Associate Members Eagan, Hock, and Templeton.

The faculty in agricultural economics in the College of Agriculture and Forestry offers major work for the degree of Master of Science in Agricultural Economics (M.S.). The faculty also cooperates in offering an Agricultural Economics option under the Ph.D. program in the Department of Economics, College of Business and Economics.

Master of Science

Students are urged to seek approval from the Admissions Committee for one of the options listed below at the time they begin work. In all cases, approval must be obtained before completion of 18 hours of course work. Students expecting to become professional agricultural economists or who hold research assistantships should seek approval of Option A. Those intending to pursue careers in agricultural business may seek approval of Option B.

Requirements for Admission

Students may be accepted for graduate study in agricultural economics on a regular or provisional basis. Students meeting all the following requirements are admitted as regular students:

1. A bachelor's degree.
2. Twelve or more semester credits in economics, agricultural economics, statistics, or appropriate social science courses.
3. A grade-point average of 2.5 for all credit in economics and agricultural economics.

Students not meeting the above minimum requirements may petition for admission on a provisional basis. The Admissions Committee will set requirements for removing provisional status in each case. Failure of a student to fulfill the terms of provisional admission shall result in automatic suspension.

Persons requesting transfer of graduate credit from courses outside Agricultural Economics must obtain approval of the Admissions Committee for such

transfer. The average for such courses transferred must be no less than 2.5. Such petitions must include all courses appropriate to the degree; courses with low grades will not be omitted.

Options of Study

A. *Thesis Option* — A minimum of 30 credit hours of approved work to include not more than 6 hours of credit for the thesis, and enough courses to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

B. *Course Work Option* — A minimum of 36 credit hours of approved course work to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

Standards of Achievement

A minimum grade-point average of 3.0 is required for all graduate credit courses taken as part of the approved program for the degree. This includes graduate credit transferred from within the University and graduate credit accumulated while pursuing a degree in agricultural economics.

Students who have earned a grade-point average of 2.75 or more with 12 or more hours of graduate credit will be admitted to candidacy. Those who do not attain this level will be placed on probation.

Examinations

Thesis Option. Satisfactory completion of an oral examination and, at the discretion of the student's graduate committee, a written examination.

Course Work Option. Satisfactory completion of a written and an oral examination.

Ph.D. Option

Under the Ph.D. option given in the College of Business and Economics, the program will consist of the Theory Core and fields of concentration in agricultural economics (12 semester hours), econometrics (9 hours) and one other field in economics (6 hours). All other requirements for the Ph.D. in economics apply to this program. (See the College of Business and Economics in Part 3 for details.)

Agricultural Economics (Ag. Ec.)

(Econ. 51 or 54 is required as a prerequisite for all graduate courses offered in Agricultural Economics.)

200. *Land Economics.* II. 3 hr. Classification, development, tenure, use, conservation, valuation, and taxation of rural, urban, mineral, forest, water, and recreational land resources. Private and public rights in land and the effect of population on the demand for land.
206. *Farm Planning.* I. 3 hr. PR: Ag. Ec. 104 or consent. Planning use of labor, soil, crops, livestock, buildings and equipment; principal factors influencing returns on farms. (Farm visits required.)

211. *Rural Economic Development*. I or II. 3 hr. Resource utilization, economic behavior and economic systems and subsystems, trade, public revenue and its allocation, distribution of income, manpower problems, development policies, and regionalization in rural areas.
231. *Marketing Agricultural Products*. I or II. 3 hr. Market organization, policies, practices, and factors affecting the marketing of agricultural products. Tour of market agencies and facilities in Pittsburgh area required.
235. *Marketing Dairy Products*. II. 2 hr. Milk-marketing policies and practices, including milk-market orders. (*Offered in Spring of odd years.*)
240. *Agricultural Prices*. I or II. 3 hr. Analysis of price-making forces which operate in the market places for the major agricultural commodities.
261. *Agribusiness Finance*. II. 3 hr. Credit needs for agricultural businesses, financing farm and market-agency firms, and organization and operation of credit agencies which finance agricultural business firms.
271. *Agricultural Policy*. II. 3 hr. Examination of economic aspects of governmental price programs, production and marketing controls, subsidies, parity, export and import policies, and other programs affecting agriculture.
330. *Cooperative Organization*. II. 3 hr. Organization, functions, and contributions of cooperatives in an economic system. (*Offered in Spring of even years.*)
342. *International Agricultural Economic Development*. I. 3 hr. Current problems, theories, policies, and strategies in planning for agricultural and rural development for increased food production and to improve the well-being of rural people in the developing countries of the world.
355. *Resource Analysis*. I. 3 hr. PR: Senior standing. Construction of models consistent with economic reality for allocating the factors of production available on farms, in forests, and in non-farm agricultural businesses to produce profit maximizing plans through use of linear and dynamic programming and electronic equipment.
431. *Advanced Agricultural Marketing*. II. 3 hr. PR: Consent. Structure of agricultural marketing; economic theory as applied to agricultural marketing with emphasis on theoretical and practical applications.
440. *Advanced Farm Management*. I. 3 hr.
441. *Production Economics*. I or II. 3 hr. PR: Consent. Economic principles of production with special application to agriculture.

Resource Management (Res. M.)

491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent.
496. *Graduate Seminar*. I, II, S. 1 hr. PR: Consent.
497. *Research*. I, II, S. 1-15 hr.

AGRICULTURAL EDUCATION

Dale K. Colyer, Chairperson, *Division of Resource Management*
2020 Agricultural Sciences Building
Degree Offered: M.A.

Graduate Faculty: Members Kelly, Lawrence, and McGhee. Associate Member Kimmons.

Candidates for the degree of Master of Science in Agricultural Education (M.S.) may be accepted on a regular or provisional basis. To be admitted as a

regular graduate student, the following requirements must be met: (1) a Bachelor's degree; (2) a grade-point average of 2.5 on all undergraduate work; (3) students who do not have a B.S. Agriculture degree with a major in Agricultural Education may be required to take a number of undergraduate courses in agriculture and professional education which are prerequisites to graduate courses required in the M.S. degree. Students not meeting the regular admission status may petition the admissions committee for entrance under one of the alternate categories in Part 2 of the *Graduate School Catalog*.

Students shall combine graduate courses in agriculture and in education by taking 16 to 20 hours in agriculture and 10 to 14 hours in education. All graduate courses offered toward a degree must be approved by the student's adviser. The student and adviser shall arrange a specific curriculum to be pursued for the degree at the beginning of the graduate program. A thesis is required as a part of the 30 hours for graduation.

Students shall complete in residence 15 hours of course work after having completed one or more years of teaching vocational agriculture. This shall apply unless the student has been granted permission by the Admissions Committee to complete graduate work without teaching experience.

Agricultural Education (Ag. Ed.)

260. *Principles of Cooperative Extension*. I. 2 hr. PR: Consent. Background, philosophy, and history of cooperative extension. Activities of county cooperative extension agents and cooperative extension programs in West Virginia. (*Offered in Fall of even years.*)
261. *Methods and Materials in Extension Education*. II. 2 hr. PR: Consent. Organization and preparation for extension teaching and the processes of communication. (*Offered in Spring of odd years.*)
263. *Teaching Young, Adult Farmer, and Off-Farm Agricultural Occupations Classes*. I. 2 hr. PR: Ed. P. 105, 106 or consent. Participation in conducting young farmer, adult farmer, and off-farm agricultural occupations classes; organization, course of study, method in teaching, and supervision of classes, young farmers' associations, adult farmers' organizations and off-farm agricultural occupations organizations. (*Also listed as C&I 263.*)
264. *Cooperative Vocational Education*. II. 4 hr. PR: Consent. Preparation for planning, organizing, and conducting high school programs of cooperative vocational education, and familiarization with business organization and operation. (*Also listed as C&I 264.*)
362. *Program Building in Cooperative Extension*. II. 3 hr. PR: Consent. Organization in relation to program building. Leadership and group action. Overall working and educational objectives, principles, method, and goals in developing county extension programs. (*Offered in Spring of even years.*)
364. *Organizing and Directing Supervised Farming and Supervised Occupational Experience Programs*. S. 2 hr. PR: Ag. Ed. 160 or consent. Planning programs of supervised farming and supervised occupational experience, supervising and evaluating such programs for day students, young farmer, adult farmer, and off-farm agricultural occupations classes and groups. (*Also listed as C&I 364.*)
460. *Planning Programs and Courses for Vocational Agriculture Departments*. S. 2 hr. PR: Ag. Ed. 160, 188. Gathering data, studying farming and off-farm agricultural occupations problems of day students, young farmers, adult farmers, and off-farm agricultural occupational groups and formulating total programs for school communities. (*Also listed as C&I 460.*)

492. *Seminar*. I, II, S. 1-3 hr. Overview and analysis of problems, literature, and research in agricultural education.

Resource Management

491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent.
496. *Graduate Seminar*. I, II, S. 1 hr. PR: Consent.
497. *Research*. I, II, S. 1-15 hr.

AGRICULTURAL MICROBIOLOGY

William L. MacDonald, *In Charge of the Graduate Program in Agricultural Microbiology*
528 Brooks Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Adams, Anderson, Bissonnette, MacDonald, Staley, and Young.
Associate Member Hindal.

The graduate curriculum in Agricultural Microbiology in the College of Agriculture and Forestry places emphasis on the interrelationships of microorganisms and their environment. Programs leading to the M.S. and Ph.D. degrees are designed to prepare students with specialization in microbiology as applied to soil, water, wastewater, agriculture, and food.

The teaching and research faculty have special interests in the areas of biotransformation of environmental pollutants, pollution abatement, public health and sanitary aspects of aquatic, terrestrial, and food environments, and the general microbial ecology of such environments.

Graduate training is designed to offer qualified students a broad background in the environmental sciences through cooperation with other disciplines in the College of Agriculture and Forestry, College of Arts and Sciences, College of Engineering, and School of Medicine. A thesis (M.S.) or dissertation (Ph.D.) is required.

Bacteriology (Bact.)

201. *Environmental Microbiology*. II. 4 hr. PR: Bact. 141 or consent. Microbiology as applied to soil, water, waste-water, sewage, air, and the general environment. Occurrence, distribution, ecology, and detection of microorganisms in these environments.
347. *Food Microbiology*. I. 4 hr. PR: Bact. 141, organic chemistry or consent. Ecology and physiology of microorganisms important in the manufacture and deterioration of foods. Techniques for microbiological examination of foods.
348. *Sanitary Bacteriology*. I. 3 hr. PR: Bact. 141. Bacteriology and health hazards associated with food handling, water treatment, and sanitary waste disposal. (*Offered in Fall of odd years.*)

AGRICULTURE

Dale W. Zinn, *Dean of the College of Agriculture and Forestry*
1170 Agricultural Sciences Building

Degree Offered: M.Agr.

Graduate Faculty: Members Adams, Anderson, Baker, Balasko, Barr, Bearce, Bennett, Bissonnette, Brooks, Butler, Colyer, Dailey, Diener, Dozsa, Dunbar, Elliott, Escouba,

Gallegly, Hoover, Horvath, Ingle, Inskeep, Jack, Jencks, Kaczmarczyk, Keefer, Kelley, Kelly, Kidder, Lawrence, Lewis, McGhee, McIntosh, MacDonald, Martin, Nath, Nelson, Nesselroad, Peters, Peterson, Prigge, Reid, Schubert, Singh, D. K. Smith, R. M. Smith, Sperow, Staley, Stelzig, Thomas, Ulrich, van Eck, Welch, Young, and Zinn. Associate Members Amrine, Blizzard, Bryan, Eagan, Elliott, Hindal, Hock, Hodge, James, Kimmons, Quinn, Sencindiver, Singha, Templeton, and Woodson.

Admission requirements are those established by the Graduate School for master's degree candidates. Students desiring this degree must obtain approval from the Master of Agriculture Committee in the College of Agriculture and Forestry. The student's baccalaureate degree should be in a field sufficiently related to the course of study contemplated to provide the necessary background. A student whose baccalaureate degree is in a field considered not sufficiently related to the study contemplated may be admitted on probation, special provisional, or regular with deficiencies until specific requirements are met or the student may be admitted on the basis of evidence of satisfactory professional experience.

Requirements. Satisfactory completion of 36 hours of course work is required for this degree. The student will select a minimum of 27 hours from the course offerings of the three divisions of Agriculture in the College (Divisions of Animal and Veterinary Sciences, Plant and Soil Sciences, and Resource Management). A minimum of 9 hours will be selected from the offerings of each division. The maximum to be counted from each division, including the problem report, will be 15 hours. No more than 3 hours of Special Topics or Advanced Study from each division may be counted towards the degree.

A three-hour problem report may be included at the option of the student and the Program Committee.

The committee charged with administering the degree program is appointed by the Dean of the College of Agriculture and Forestry.

The graduate committee of each candidate shall have one member of the administering committee as a member. This member shall not be the chairperson or student adviser.

The student may choose the additional courses from within the College of Agriculture and Forestry or from offerings of other colleges and schools of WVU. An overall grade-point average of 3.0 is required for graduate courses included as part of the approved program for the degree. Upon completion of the course work each candidate must undergo both a written and oral examination by the candidate's graduate committee.

Agriculture (Ag.)

- 200. *Agricultural Travel Course.* S. 6 hr. Tour and study of production methods in major livestock and crop regions of the United States and other countries. Influence of population, climate, soil, topography, markets, labor, and other factors on agricultural production.
- 360. *Problem Report for the Degree of Master of Agriculture.* I, II, S. 1-3 hr.

AGRONOMY

C. B. Sperow, *In Charge of the Graduate Program in Agronomy*
1078 Agricultural Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Baker, Balasko, Bennett, Butler, Jencks, Keefer, Singh, Smith, Sperow, and van Eck. Associate Members Bryan, Sencindiver, Singh, and Stout.

The agronomy faculty in the College of Agriculture and Forestry offers the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. Agronomy is customarily divided into Crop Sciences and Soil Sciences and deals with the problems in plant development and crop production and the properties and uses of soils.

Thesis and dissertation problems in Crop Sciences are selected in forage production, forage quality, forage/livestock systems, grazing management, brush and weed control in forage crops, and intercropping of annual forage crops. In Soil Sciences, the problems are selected in the areas of pre-mining overburden analyses and minesoils properties, characteristics and utilization of sewage sludge, flyash and other soil amendments, and mineral nutrition of crops. Research problems change in response to needs of the state and region. Cooperative research with other units of WVU, and with research units in other states and overseas, are undertaken as the need and opportunity occurs.

Facilities for graduate research include several farms, greenhouses, growth chambers, modern laboratories, and specialized equipment.

The student must have a bachelor's degree from any approved college and an adequate background in the physical and biological sciences. Additional undergraduate work may be required according to the needs of the field of specialization of the student. The courses required for graduate study will vary depending on the crops and soils emphasis. They are developed in consultation with the student's adviser and advisory committee.

Course work in entomology is designed to give the student a broad background in basic and applied aspects of the discipline. Students may specialize in pest management, entomology of crops, forests, or urban environment, apiculture, aquatic entomology, medical entomology, acarology, araneology, or insect physiology, morphology, ecology, behavior or systematics. Students wishing to emphasize entomology enroll in the Crop Science option of the graduate program in agronomy. (See *Entomology courses listed in Part 4.*)

Agronomy (Crop Science) (Agron.)

- 250. *Turfgrass Management. I.* 3 hr. PR: Agron. 2, or consent. Establishment, maintenance, and adaptation of grasses and legumes for lawns, golf courses, parks, athletic fields, and roadsides. Associated differential plant responses with soil, climatic, and biotic factors. Field trips arranged.
- 251. *Weed Control. I.* 3 hr. PR: Pl. Sc. 52, Agron. 2, or consent. Fundamental principles of weed control. Recommended control measures for and identification of common weeds. 2 lec., 1 lab. (*Offered in Fall of odd years.*)
- 252. *Grain and Special Crops. II.* 3 hr. PR: Pl. Sc. 52, Agron. 2, or consent. Advanced study of methods in the production of grain and special crops. Varieties, improvement, tillage, harvesting, storage, and uses of crops grown for seed or special purposes. (*Offered in Spring of even years.*)
- 254. *Pasture and Forage Crops. I.* 4 hr. PR: Pl. Sc. 52, Agron. 2, or consent. All phases of pasture and forage crop production, including identification, seeding, management, use, seed production, and storage of forage crops. 3 lec., 1 lab.

Agronomy (Soil Science) (Agron.)

- 210. *Soil Fertility. I.* 3 hr. PR: Agron. 2 or 10. Soil properties in relation to fertility and productivity of soils; evaluation of soil fertility; production of fertilizers and their use in increasing soil fertility and productivity.

212. *Soil Conservation and Management*. II. 3 hr. PR: Agron. 2 or 10. Using soil technology to solve soil management problems relating to cropping systems. Field diagnosis of soil problems stressed.
230. *Soil Physics*. II. 3 hr. PR: Agron. 2 or 10. Physical properties of soils, water and air relationships and their influence on soil productivity. (*Offered in Spring of even years.*)
255. *Elements of Pedology*. II. 3 hr. PR: Consent. Pedologic definitions and principles will be applied to advance planning, practices, and continuing use of highly disturbed or man-made soils being created by such activities as mining and urbanization. (*One all-day field trip required.*)
301. *Geotechnic*. I. 3 hr. PR: Consent. A unified approach to various aspects of soil formation and influence of formative factors on the nature of soils and their use as engineering materials. Course serves as a common meeting ground for students in the various disciplines concerned with earth science. 3 lec. (*Offered in Fall of odd years.*)
315. *Soil Genesis and Classification*. I. 3 hr. PR: Agron. 2 or 10. Origin and formation of soils. Study of soil profiles and soil forming processes in field and laboratory. Principles of classification and techniques of soil mapping. 2 lec., 1 lab. (*Offered in Fall of even years.*)
410. *Advanced Soil Fertility*. II. 3 hr. PR: Agron. 210. Biol. 169 or consent. Influence of soil chemical and physical properties on availability of plant nutrients; intensive study of individual plant nutrients and interactions of nutrients in soils and crops. (*Offered in Spring of even years.*)
416. *Soil Chemistry*. I. 3 hr. PR: Consent. Chemistry of soil development; chemical and mineralogical composition of soils; nature and properties of organic and inorganic soil colloids; soil acidity; cation and anion exchange phenomena; soil chemistry of macro- and micro-nutrients. (*Offered in Fall of odd years.*)
418. *Chemistry of Soil Organic Matter*. II. 3 hr. PR: Organic chemistry or consent. Chemical composition of soil organic matter studied in relation to its physico-chemical properties and humus formation. Methods involving extraction, fractionation, and purification of soil organic components examined. 2 lec., 1 lab. (*Offered in Spring of odd years.*)
421. *Identification of Clay Minerals in Soil*. II. 3 hr. PR: Physical chemistry or consent. Characterization of clay minerals is an important aspect in soils, geology, civil engineering, and related fields. Study of methods used in qualitative and quantitative identification of these secondary minerals in soils and rocks. 1 lec., 2 lab. (*Offered in Spring of even years.*)
451. *Seminar in Micropedology*. I. 2 or 3 hr. PR: Second-year graduate and consent. Principles of optical mineralogy and of the polarizing microscope as applied to the study of soil minerals and soil fabrics. (Cross-listed as Geol. 451.) (*Offered in Fall of even years.*)

ANATOMY

Robert S. McCuskey, Chairperson of the Department

4052 Basic Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Beresford, Carmichael, Culberson, Frederickson, Friedman, Haines, Hilloowala, Hinton, McCafferty, McCuskey, Overman, Pinkstaff, Reilly, Reyer, and Walker. Associate Member Pope.

The Department of Anatomy in the School of Medicine offers graduate programs which are committed to the training of competent researchers and

capable teachers. This is accomplished by the completion of a carefully designed plan of study tailored to the individual student's interests. The program begins with instruction in basic morphological, developmental, and functional aspects of human anatomy. Additional related course work and electives are required. These selected courses strengthen the area of interest of the student. The student then conducts an original research project which culminates in a dissertation (Ph.D.) or a thesis (M.S.).

Admission Requirements

In addition to the admission procedure of the Graduate School, the Department of Anatomy requests that each applicant complete a departmental application form, obtained from the department. After an application is favorably reviewed by the departmental Graduate Committee, applicants are invited for a personal interview whenever practical. The applicant is admitted by a majority vote of the departmental faculty.

It is recommended that the following courses be completed before entering the graduate program: algebra, trigonometry, general physics, inorganic and organic chemistry, general biology or zoology, comparative anatomy, embryology, genetics, cell biology or general physiology, and two years of French, German, or Russian. At the discretion of the department, a student may be allowed to complete a limited number of prerequisites after enrolling in the program. A grade-point average above 3.0 is desirable. The aptitude portion and an advanced section of the Graduate Record Examination are generally required. Also, three letters of recommendation from persons who can best evaluate the applicant's potential for graduate study should either accompany the application or be mailed to the Department of Anatomy separately. Applicants who desire consideration for financial aid should complete the application process before January 15.

Doctor of Philosophy

The first year of study is usually occupied with required course work within the Department of Anatomy. These courses include gross anatomy, microanatomy, neurobiology, introduction to research, and seminar in anatomy. Required courses in other basic medical sciences, such as biochemistry and physiology, are usually taken in the second year. Twelve hours of additional graduate-level courses are also required. These requirements will have been satisfied when the student earns a grade of at least B in each of the courses taken in the Department of Anatomy and has maintained a 2.75 overall grade-point average as required by the Graduate School.

To be admitted to candidacy for the Ph.D. degree the student must satisfy the above requirements, demonstrate a reading knowledge of one foreign language, pass a written and oral comprehensive preliminary examination, and prepare a plan for a research project to be undertaken for the dissertation. To be recommended for the Ph.D. degree each student must complete a dissertation based on original research and defend the dissertation at an oral examination.

This program allows flexibility for each student. The precise plan of study is designed by the student and an Advisory Committee, which is composed of faculty members selected by the student.

The student often culminates the training period with presentations at regional and/or national scientific meetings. The Southern Society of Anatomists

and the American Association of Anatomists are the most suitable meetings for this purpose.

Master of Science

The master's program in Anatomy is offered as a terminal degree only for students in certain specialized fields, such as physical therapy or in a conjoint program in dentistry or medicine. It is not necessary for the student to complete the M.S. degree in order to qualify for admission into the Ph.D. program, although the student may elect to complete the requirements for this degree in progress toward the Ph.D.

An applicant who shows a special need for the M.S. degree must generally be as well qualified as applicants for the doctoral program. The M.S. student must complete courses in gross anatomy and microanatomy plus 6 to 9 hours of required and elective courses. A 2.75 grade-point average must be maintained. In addition to course work the student must complete a thesis based on original research and defend the thesis at an oral comprehensive examination.

Research and Instruction

Research Areas — Gross Anatomy; Anatomical variations and anomalies, and electromyographic studies of specific muscle groups. Microscopic Anatomy: Studies of cells, tissues and organs, under normal and experimental conditions with in vivo microscopic, histochemical, electron microscopic, autoradiographic, and fluorescent techniques. Developmental Anatomy: Experimental and descriptive embryology, cellular differentiation, and dedifferentiation, regeneration and the effects of drugs and other environmental agents on development. Neuroanatomy: Experimental, comparative and embryological studies of specific nerve cell groups and nerve pathways in the spinal cord, brain stem, cerebellum, and cerebrum.

Anatomy (Anat.)

101. *Principles of Human Anatomy.* (For paramedical students only.) I 3-4 hr. PR: Biol. 2 or equiv.; consent of instructor or chairperson. Lectures and demonstrations on the gross and microscopic anatomy of the human body including development.
102. *Gross Anatomy.* (For physical therapy students.) II. 3 hr. PR: Anat. 101 and/or consent of instructor or chairperson. Functional gross anatomy of the back, extremities, head and neck.
103. *Microanatomy.* (For physical therapy students.) I. 2 hr. PR: Consent of instructor or chairperson. Introductory cell and tissue structure.
109. *Oral Histology.* (For dental hygiene students.) II. 3 hr. PR: Consent of instructor or chairperson. Histological structure and embryological development of the teeth, tissues, and organs of the oral cavity.
152. *Introduction to Physical Anthropology.* II. 3 hr. PR: Consent of instructor or chairperson. Man's physical heritage (human evolution) in principle and through paleontology, man's current physical nature (race and ecology), and biologic basis of man's culture. (Same as *Sociology/Anthropology 152.*)
301. *Gross Anatomy of the Trunk.* (For medical and a limited number of regular full-time graduate student in basic medical sciences.) I. 5 hr. PR: Medical student standing or consent of chairperson. Gross anatomical study of the back, thorax, abdomen, pelvis, and perineum.

302. *Gross Anatomy of the Head and Neck.* (For medical and a limited number of regular full-time graduate students in the medical basic sciences.) I. 3 hr. PR: Medical student standing or consent of chairperson. Gross anatomical study of the head and neck.
304. *Gross Anatomy of the Extremities.* (For medical students and a limited number of regular full-time graduate students in the medical basic sciences.) I. 2 hr. PR: Medical student standing or consent of chairperson. Gross anatomical study of the upper and lower extremities.
305. *Microanatomy.* (For medical students and a limited number of regular full-time graduate students in the medical basic sciences.) II. 5 hr. PR: Medical student standing or consent of chairperson. Cells, tissues, and organs.
306. *Gross Anatomy of the Trunk and Extremities.* (For dental and a limited number of regular full-time graduate students in the medical basic sciences.) II. 4 hr. PR: Dental student standing or consent of instructor or chairperson. Gross anatomical study of the back, upper extremities, thorax, abdomen, and pelvis.
307. *Gross Anatomy of the Head and Neck and Neuroanatomy.* (For dental and a limited number of regular full-time graduate students in the medical basic sciences.) II. 5 hr. PR: Dental student standing or consent of instructor or chairperson. Gross anatomical study of the head and neck and a brief gross and microscopic anatomical study of the central nervous system.
308. *Neuroanatomy.* (For students in physical therapy and a limited number of regular full-time graduate students in the medical basic sciences, and students in other health sciences.) II. 2 hr. PR: Consent of instructor or chairperson. Gross and microscopic structure of the central nervous system. (See also Conjoined Course 375, Neurobiology.)
309. *Microanatomy and Organology.* (For dental and a limited number of regular full-time graduate students in the medical basic sciences.) I. 4 hr. PR: Dental student standing or consent of chairperson. Cells, tissues, and organs.
312. *Special Topics in Anatomy.* I, II. 2-4 hr. per sem. PR: Anat. 301 or 306; and Anat. 305 or 309; consent of chairperson. Different topics of current interest in anatomy, not included in the regular graduate courses.
314. *Applied Anatomy.* I, II. 2-6 hr. per sem. PR: Consent of instructor or chairperson. Detailed study of anatomy adapted to the needs of the individual student.
315. *Craniofacial Osteology and Myology.* I. 3 hr. PR: Dental, medical or graduate student standing or consent of instructor. Study of craniofacial embryology, morphology, and physiology with special emphasis on articulations and their clinical applications.
316. *Craniofacial Growth and Maturation.* II. 3 hr. PR: Anat. 315 or consent of instructor. The current concepts of craniofacial growth and maturation are presented and integrated for application to clinical problems.
318. *Oral Histology and Embryology.* (For dental and a limited number of regular full-time graduate students in the medical basic sciences.) I. 2 hr. PR: Dental student standing or consent of instructor or chairperson. Structure, function, and development of oral tissues.
375. *Neurobiology.* (For medical and limited number of regular full-time graduate students in the medical basic sciences.) II. 6 hr. PR: Anat. 301 and Physi. 345, or consent. Anatomy and physiology of the nervous system correlated with clinical neurology.
401. *Advanced Gross Anatomy.* I, II. 2-6 hr. per sem. PR: Anat. 301, 302, 304, or 306, 307, and consent of instructor or chairperson. Morphological and functional analysis of a selected region, with dissection.

402. *Advanced Developmental Anatomy*. II. 2-4 hr. per sem. PR: Anat. 301, 302, 304, and consent of instructor or chairperson. Detailed developmental anatomy of the fetal period and infancy. With dissections and analysis of variations and malformations.
403. *Seminar*. I, II. 1-6 hr. (1 hr. per sem.) (Course may be repeated.) PR: Consent of Graduate Committee. Special topics of current or historical interest.
405. *Experimental Embryology*. II. (Alternate Years.) 3 hr. PR: Embryology and cellular physiology or biochemistry and consent of instructor or chairperson. Development, differentiation, and regeneration.
406. *Advanced Neuroanatomy*. I. 2-4 hr. per sem. (Course may be repeated.) PR: Conjoined Course 375 and consent of instructor or chairperson. Detailed study of selected areas of the nervous system.
408. *Histochemistry*. II. (Alternate Years.) 3 hr. PR: Anat. 305 or 309, biochemistry, and consent of instructor or chairperson. Histochemical theory and techniques.
451. *Advanced Microanatomy*. I, II, or S. 2-4 hr. PR: Anat. 305 or 309, or Biol. 263 and consent of instructor or chairperson. An extension of the major topics included in Anat. 305 or 309. Special emphasis on recent contributions.
491. *Advanced Anatomy*. I, II. 2-8 hr. PR: Consent of chairperson.
497. *Research*. I, II, S. 1-15 hr. PR: Consent of Graduate Committee. (May be repeated as needed with consent of Graduate Committee.)

ANIMAL NUTRITION

John D. Sink, *Chairperson of the Division of Animal and Veterinary Sciences*
G038 Agricultural Sciences Building

Degree Offered: Ph.D.

Graduate Faculty: Members Anderson, Escoubas, Hoover, Horvath, Martin, Prigge, Reid, and Thomas.

The Division of Animal and Veterinary Sciences offers a doctor of philosophy program in animal nutrition which allows maximum flexibility in courses and research problems. Students may work with beef and dairy cattle, sheep, swine, poultry, or laboratory animals. Research problems in farm animals form the basis for many studies, but a comparative approach is emphasized.

Admission requirements are similar to those in other biological sciences. The student should have completed basic courses in the physical and biological sciences, including genetics, nutrition, and physiology. In addition, analytical chemistry and organic chemistry (one year) are required. Deficiencies may prolong the time needed to complete degree programs.

The minimum undergraduate grade-point average for admission shall be either 2.75 overall or 3.0 for the last 60 hours of undergraduate work. A composite GRE score of 1,000 or better will be considered as a basis of admission. The fact that an applicant meets one or more of the above requirements shall not guarantee admission since each professor will accept only the number of advisees which can be supervised adequately with available facilities, time, and funds. Doctoral programs are governed by the Graduate School general regulations.

(See courses listed under the Animal Science Master of Science Degree Program, pages 76-78.)

ANIMAL SCIENCE

John D. Sink, Chairperson of the Division of Animal and Veterinary Sciences
G038 Agricultural Sciences Building

Graduate Faculty: Members Anderson, Dailey, Dozsa, Dunbar, Escoubas, Hoover, Horvath, Inskeep, Kelley, Kidder, Lewis, Martin, Peters, Peterson, Prigge, Reid, Thomas, Welch, and Zinn. Associate Members Wamsley and Woodson.

Master of Science

The master of science program in animal science allows maximum flexibility in courses and research problems. Students may work with beef and dairy cattle, sheep, swine, poultry, or laboratory animals. They may emphasize physiology, production, breeding, nutrition, or meat science. Research problems in farm animals form the basis for many studies, but a comparative approach is emphasized.

Admission requirements are similar to those in other biological sciences. The student should have completed basic courses in the physical and biological sciences, including genetics, nutrition, and physiology. Deficiencies may prolong the time needed to complete degree programs.

The minimum undergraduate grade-point average for admission shall be either 2.75 overall or 3.0 for the last 60 hours of undergraduate work. A composite GRE score of 1,000 or better will be considered as a basis of admission. The fact that an applicant meets one or more of the above requirements shall not guarantee admission since each professor will accept only the number of advisees which can be supervised adequately with available facilities, time, and funds.

A minimum of twenty-four approved hours of course work and a thesis are required for all master of science degrees. The doctoral programs are governed by the Graduate School general regulations.

Animal and Veterinary Science (A&VS)

- 491. *Special Topics*. I, II, S. 1-4 hr. (1 hr. credit in special cases only). Advanced study in particular phases of such animal science topics as animal production, nutrition, physiology, breeding and genetics, veterinary science, and food science. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
- 497. *Research*. I, II, S. 1-15 hr. Research in animal nutrition, physiology, breeding and production and veterinary science.

Animal Nutrition (An. Nu.)

- 294. *Poultry Nutrition*. II. 3 hr. PR: An. Nu. 101. Nutritional requirements, interrelationships, and deficiencies of all types of domesticated fowl.
- 301. *Principles of Nutrition and Metabolism*. I. 3 hr. PR: Ag. Bi. 210, or consent. A basic course in principles of nutrition with emphasis on the major classes of dietary nutrients and their digestion and utilization.
- 302. *Nutrition and Physiological Function*. II. 3 hr. PR: An. Nu. 301 or consent. Sequence to An. Nu. 301. Techniques used in nutritional studies and the relationship of nutrient requirements to physiological function in species of laboratory and domestic animals and man.
- 304. *Nutrition Laboratory Methods*. II. 2 hr. PR: An. Nu. 301 and consent. Diet preparation, food analysis, management of laboratory animals, demonstration of specific

nutrient deficiencies, and the conduct and analysis of animal feeding trials designed to examine the nutritional properties of experimental diets.

- 491. *Advanced Studies*. I, II, S. 1-6 hr. Topics in advanced nutrition. Subject will be selected by staff for formal presentation. Repeat registration permitted for maximum of 6 credit hours per year.
- 496. *Seminar*. I, II. 1 hr.

Animal Physiology and Breeding (An. Ph.)

- 204. *Animal Physiology Laboratory*. I. 2 hr. PR: An. Ph. 100 or consent. Laboratory study of the physiological systems of animals and the influences of environment on these systems.
- 225. *Physiology of Reproduction*. II. 3 hr. PR: Course in biology. Comparative physiology of reproduction in higher animals; endocrine functions involved in reproduction; genetic and environmental variations in fertility mechanisms.
- 226. *Breeding of Farm Animals*. I. 3 hr. PR: Course in genetics or consent. Application of principles of quantitative genetics to the improvement of farm animals.
- 280. *Behavioral Patterns of Domestic Animals*. II. 3 hr. (1 lab.). Examination of the bases for exhibition and control of behavioral patterns of domestic animals.
- 425. *Endocrinology of Reproduction*. II. 4 hr. (2 labs.). PR: An. Ph. 225 or Biol. 268 or equiv. Discussion of and laboratory experience in classical and current concepts of hormonal and neurohormonal regulations of reproductive phenomena with emphasis on species differences and similarities. (*Offered in Spring of odd years.*)
- 426. *Advanced Animal Selection*. II. 3 hr. PR: Course in Statistics and course in Genetics or equiv. An advanced course dealing with the basic concepts of experimental and statistical approaches in the analysis of quantitative inheritance with special reference to the magnitude and nature of genotypic and non-genotypic variability. (*Offered in Spring of even years.*)
- 496. *Seminar*. I, II. 1 hr.

Animal Production (An. Pr.)

- 240. *Poultry Production*. I. 3 hr. (1 lab.). PR: An. Nu. 101. Special phases of broiler and egg production, disease control, labor-saving studies, and recent designs in housing and equipment for all types of poultry.
- 250. *Current Literature in Animal Science*. I. 3 hr. PR: An. Nu. 101. Evaluation of current research in animal science and its application to production and management.
- 422. *Advanced Milk Production*. II. 3 hr. PR: An. Nu. 101 or consent. Advanced study of the feeding, breeding, and management of dairy cattle.

Food Science (Fd. Sc.)

- 267. *Advanced Meat Science*. II. 3 hr. PR: Fd. Sc. 167. Carcass composition, the transformation of muscle to meat, and properties of meat which affect water binding capacity, pigment formation, meat texture, fiber characteristics, and meat palatability are studied. Marketing trends also are investigated.

Veterinary Science (Vet. S.)

- 210. *Principles of Laboratory Animal Science*. I. 3 hr. (1 lab.). PR: Consent for undergraduates. The management, genetics, physiology, nutrition, disease, and germ-free quartering of common laboratory animals.

305. *Parasitology*. II. 3 hr. PR: Course in biology. Common parasites of farm animals, their control, and their effect upon the host. (*Offered in Spring of odd years.*)

ART

Urban Couch, *Chairperson of the Division*
419-A Creative Arts Center

Degrees Offered: M.A., M.F.A.

Graduate Faculty: Member Couch. Associate Members Anderson, Charles, Freedman, Harvey, Nakashima, Rajam, and W. J. Thomas.

The graduate program of the Division of Art is a highly selective, closely integrated part of a program of professional education in art. All candidates are expected to have a high degree of artistic maturity and a desire to achieve excellence in their chosen area of concentration.

Candidates must comply with the standards established by the Graduate School and Division of Art, Creative Arts Center, West Virginia University.

Master of Fine Arts in Art (M.F.A.)

Admission Requirements: Applicants seeking admission to the Master of Fine Arts in Art (M.F.A.) program must have a baccalaureate degree in art or the equivalent. Preparatory study should include 12 hours of art history, 70 hours of studio art related to professional needs, and 36 hours of general education courses.

Degree Requirements: Candidates for the M.F.A. degree must complete a 60-hour program including 36 hours in a specified field of art; 12 hours of electives within the Division of Art; 6 hours of electives outside the division; and 6 hours dedicated to a graduate exhibition and a problem report (thesis). The major fields of concentration are ceramics, graphic design, painting, printmaking, and sculpture.

All candidates enrolled in the M.F.A. program are required to submit a statement of intention upon successfully completing 12 hours of graduate work toward their degree. This statement should indicate the direction and implementation of their studio involvement and include a comprehensive outline of their written thesis.

Students accepted into the M.F.A. program are required to spend four full-time semesters (excluding summer sessions) in residence. A waiver of this requirement may be requested from the Chairperson of the Division of Art based on accepted graduate transfer credit or previously completed degree requirements.

Candidates may request up to 30 hours of credit for advanced standing if they meet the regular requirements of the Graduate School and the Creative Arts Center, and if they have completed the degree of Master of Arts in Art or the equivalent. The request for advanced standing must be made to the Division of Art Chairperson at the time of application and must be approved by the student's graduate adviser and the Graduate School.

Master of Arts in Art (M.A.)

Admission Requirements: Applicants desiring to begin a course of study leading to the Master of Arts (M.A.) in Art degree must have a baccalaureate degree in art or the equivalent. Undergraduate study should include 12 hours of art history, 45 hours of studio art related to professional needs, and 36 hours of general education courses.

Degree Requirements: Candidates for the M.A. in Art degree must complete a 30-hour program designed to meet specific needs of the graduate art major. The exact courses of study will be determined in consultation with the student's graduate advisor. A graduate exhibition and problem report (thesis) may be required depending on the recommendation of the graduate art faculty.

Master of Art in Art Education (M.A.)

Admission Requirements: Applicants for the Master of Arts in Art Education (M.A.) degree must have a baccalaureate degree in art, art education, or the equivalent. Undergraduate study should include a minimum of 6 hours of art history, 40 hours of studio art related to professional needs, and 30 hours of general education courses.

Degree Requirements: Candidates for the M.A. in Art Education degree must complete a 30-hour program designed for specialization in Art Education. The exact course of study will be determined in consultation with the student's graduate adviser. A graduate exhibition and problem report (thesis) may be required depending on the recommendation of the graduate art faculty. Please direct inquiries concerning this degree program to the Art Education Coordinator, Division of Art.

An option of this degree program is the Master of Arts in Secondary Education which is offered in cooperation with the College of Human Resources and Education. Please direct inquiries concerning this degree program to the Art Education Coordinator, Division of Art.

Undergraduate Deficiencies: All deficiencies in undergraduate preparation must be completed before the applicant is admitted as a regular student in the degree program requested. It should be understood that specified deficiency credits do not count toward master degree requirements.

Materials and Equipment Notice: All graduate art majors are required to purchase some personal equipment and expendable supplies.

Application Procedures: Requests for application to graduate degree programs in art should be addressed to the Office of Admissions and Records, West Virginia University, Morgantown, WV 26506. Applicants must specify the degree and subject area of their choice. For admission to the graduate art program, applicants must present a portfolio of twenty 2" by 2" color slides of their work arranged and mailed in an 8" by 11" transparent plastic slide holder. Each slide must have the applicant's name, date of completion, size of work, and type of medium. Send slide portfolios to the Graduate Adviser, Division of Art, Creative Arts Center, West Virginia University, Morgantown, WV 26506. (Please include a self-addressed, stamped envelope to assure safe return of visual material.)

Graduate applications and slides must be submitted by March 1. Applicants for graduate studies in art are reviewed by the graduate art faculty one time each academic year. Final acceptance in all of the graduate programs in art depends on the recommendations of the Graduate Art Faculty and the available facilities.

Applicants should be notified of their status by the last week of March.

Art (Art)

200. *Directed Art Studies. I, II, S. 1-15 hr. (May be repeated for credit.) PR: Consent. Studies in painting, sculpture, printmaking, graphic design, ceramics, drawing, art education, art history; includes independent study.*

211. *Figure Drawing*. I, II, S. 3 hr. PR: Art 12, 121 or equiv. A course of compositional structure from the figure.
212. *Advanced Drawing*. I, II, S. 3 hr. (May be repeated for credit.) PR: Art 211 or equiv. Advanced tutorial drawing course.
300. *Graduate Art Studies*. I, II, S. 1-15 hr. (May be repeated for credit.) PR: Consent. Studies in painting, sculpture, printmaking, graphic design, ceramics, drawing, art education, art history; includes independent study.
400. *Graduate Exhibition and Problem Report*. I, II. 3-6 hr. PR: Consent.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and graduate student body.

BIOCHEMISTRY

Fred Butcher, *Acting Chairperson of the Department*

3124 Basic Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Blair, Butcher, Canady, Ellingson, Harris, Jagannathan, Katz, Kletzien, Koppelman, Miller, Rafter, Resnick, Tryfiates, Wimmer, and Wirtz.

Graduate programs in the Department of Biochemistry are designed to assist students in the development of their own capabilities for independent thought and research. All students are provided with a strong biochemistry background; however, the program has sufficient flexibility to allow individual students to select advanced specialty courses in biochemistry which are of particular importance to their career goals. Faculty research problems are of current interest and are diverse, reflecting the broad spectrum of areas encompassing biochemistry. Specific major areas of research in the Department of Biochemistry include: elucidation of specific mechanisms of enzyme catalysis; protein conformation changes induced by metals; cytochrome P-450 oxidative processes; characterization of immune complement interaction with red cell membranes; investigations into microbial infection processes; membrane alteration during differentiation in the cellular slime mold; hormonal regulation of animal cell metabolism; control of secretory processes; tRNA synthesis and maturation; regulation of mammalian cell growth; control of eukaryotic DNA synthesis; carcinogenesis; energy-coupled ATP synthesis/hydrolysis.

Admission Requirements

A prospective graduate student should hold a bachelor's degree with a science major and should have successfully completed courses in qualitative-quantitative, chemical analysis, organic chemistry, calculus, physics, and physical chemistry. In some cases, a deficiency in the above may be made up after admission to the program.

Application is made by submission of the following items to the Department of Biochemistry: (a) the completed departmental application form (sent on request); (b) three letters of recommendation from professors who can evaluate the student's present abilities and potential; (c) official transcript of the applicant's college grades; and (d) official copy of Graduate Record Examination (GRE) scores. Due to the sequence of courses, entrance in the fall is preferred; but exceptions may be made as necessary. Application material and program details may be obtained by writing: The Graduate Coordinator, Department of

Biochemistry, School of Medicine, West Virginia University, Morgantown, WV 26506. The deadline for receipt of applications and supporting documents by the department is June 1; to be considered for financial support, applications should be submitted much earlier, preferably by February 1.

Biochemistry (Bioch.)

- 139. *Introduction to Biochemistry*. I. 4-5 hr. PR: Inorganic chemistry. (For pharmacy and medical technology students; others by consent.) Lecture and conference, 4 hr.; Laboratory, 1 hr.
- 192. *Selected Topics in Biochemical Research*. I, II, S. 1-6 hr. (May be repeated for a maximum of 12 hr.) PR: Consent.
- 231. *General Biochemistry*. I. 7 hr. PR: Inorganic chemistry, organic chemistry. (For medical students and regular full-time graduate students in basic science departments.) Main lectures (all), conference (medical students), and lecture/problem session (graduate students).
- 239. *Clinical Chemical Techniques*. II. 4 hr. PR: Bioch. 139, 231 or equiv. (Primarily for medical technology students; open to other qualified students by consent.)
- 305. *General Biochemistry*. II. 4 hr. PR: Inorganic chemistry, organic chemistry, and consent. (Dental and graduate students.) Lecture, conference, and demonstration.
- 399. *Special Topics*. I, II. 1-2 hr. PR: Consent.
- 423. *Immunochemistry*. II. 2 hr. PR: Consent. Chemistry and biochemistry of antibodies, antigens, and complement.
- 491. *Advanced Study*. I, II. 1-6 hr. PR: Consent. Physical techniques in biochemistry. Nucleic acids and membrane biochemistry. Designed primarily to provide a background for students who will do research in biochemistry and molecular biology. Emphasis will be on principles, concepts, and techniques useful for the solution of important biological research problems.
- 496. *Graduate Seminar*. I, II. 1 hr. PR: Bioch. 231 or equiv., consent. Presentation and discussion of special topics.
- 497. *Research*. I, II, S. 1-15 hr.

BIOLOGY

Martin W. Schein, *Chairperson of the Department*
200 Brooks Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Allen, Bennett, Blaydes, Clarkson, Clovis, Collins, Dashek, DeCosta, Dunning, Frist, Guthrie, J. E. Hall, Hertig, Hurlbutt, Keller, Lang, Marshall, Quinlan, Schein, Sutter, Wearden, and Williams. Associate Members Benson, Coover, and Montiegel.

The Department of Biology offers work leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in biology. The department has certain requirements in addition to those of the Graduate School. Information concerning the graduate programs may be acquired by writing the Chairperson, Department of Biology, before seeking admission. Students may enroll in graduate courses and may work toward an advanced degree only with the approval of the department.

Applicants are expected to have a broad foundation of training in biology and related sciences, particularly chemistry, mathematics, and physics. The ap-

plicant also is expected to present Graduate Record Examination scores and three letters of recommendation for evaluation. Deficiencies in undergraduate training may prolong the time for completion of the required program for advanced degrees.

The Wallops Island Marine Science Center at Wallops Island, Virginia, is available for selected graduate courses in marine biology. Research opportunities at the M.S. and Ph.D. level are also available in marine biology. Contact the Marine Science Director, Department of Biology, for information.

Biology (Biol.)

201. *History of Biology*. I. 3 hr. PR: Biol. 1 and 2 or equiv. History of development of biological knowledge, with philosophical and social backgrounds.
209. *Topics and Problems in Biology*. I, II, S. 1-4 hr. PR: Consent. Topics and problems in contemporary biology. All topics or problems must be selected in consultation with instructor.
211. *Advanced Cellular and Molecular Biology*. I. 4 hr. PR: Biol. 104. Advanced study of fundamental cellular activities and their underlying molecular processes.
215. *Cytology*. 4 hr. PR: Biol. 1 and 2 or equiv. Cells, their structure and function.
216. *Cell and Molecular Biology Methods*. I. 3 hr. PR: Biol. 104 or consent. Introduction to the theory and application of basic analytical tools used in molecular biology. Included in selected topics are: hydrodynamic methods, chromatography, electrophoresis, and general laboratory methods. (*Offered in Fall of even years.*)
217. *Methods in Ecology and Biogeochemistry*. II. 3 hr. PR: Biol. 103, consent. Introduction to the theory and application of basic analytical tools used in ecology and biogeochemistry. Selected topics included are: sampling of terrestrial and aquatic organisms and their environment and chemical analyses of biological materials. (*Offered in Spring of odd years.*)
231. *Animal Behavior*. I. 4 hr. PR: Biol. 1 and 2 or Psych. 1, or equiv. Introduction to animal behavior (ethology) emphasizing the biological bases and evolution of individual and social behaviors; laboratory includes independent investigation of behavioral phenomena.
232. *Physiological Psychology*. I. 3 hr. PR: 9 hr. psychology, behavior, physiology, or graduate standing. Introduction to physiological mechanisms and the neural basis of behavior. (*Also listed as Psych. 232.*)
233. *Behavioral Ecology*. II. (Alternate Years.) 3 hr. PR: Biol. 231 or consent. Consideration of the influences of environmental factors on the short- and long-term regulation, control, and evolution of the behaviors of animals.
234. *Physiology of Animal Behavior*. II. (Alternate Years.) 3 hr. PR: Biol. 231 or consent. Explores the way behavior is controlled in a wide variety of animals so that commonalities and varieties of neural and endocrine mechanisms may be better understood.
235. *Primate Behavior*. II. 3 hr. PR: Consent. Primates as they exist in their natural habitats, as they suggest clues to human behavior and the evolution of behavior. Case studies and comparative primate behavior of prosimians to monkeys, to apes, to human hunters and gatherers. (*Also listed as Soc&A 257.*)
243. *Plant Ecology*. I. 4 hr. PR: Biol. 1 and 2 or equiv. Environmental and ecological relationships of plants.
246. *Limnology*. I. 4 hr. PR: Biol. 103 or consent. Physical, chemical and biological characteristics of inland waters with an introduction to the principles of biological productivity.

250. *Aquatic Seed Plants*. I. 3 hr. PR: Biol. 1 and 2, or equiv. Classification, ecology, and economic importance of aquatic seed plants.
251. *Principles of Evolution*. I, S. 3 hr. PR: Biol. 1 and 2 or equiv. Introduction to the study of evolution.
252. *Flora of West Virginia*. II, S. 3 hr. PR: Biol. 1 and 2 or equiv. Consideration of the native plant life of the state.
253. *Plant Anatomy*. I. 4 hr. PR: Biol. 1 and 2 or equiv. Anatomy of seed plants. (*Offered in Fall of odd years.*)
254. *Plant Geography*. II, S. 3 hr. PR: Biol. 1 and 2 or equiv. Study of plant groupings and worldwide distribution of plants.
255. *Invertebrate Zoology*. II. 4 hr. Biol. 1 and 2 or equiv. Advanced study of animals without backbones.
256. *Ornithology*. II. 3 hr. PR: Biol. 1 and 2 or equiv. Lecture and laboratory studies on ancestry, evolution, topography, anatomy and physiology, systematics, behavior, migration, and ectoparasites of birds. Field studies will be limited in scope.
257. *Ichthyology*. I. 3 hr. PR: Biol. 101 or consent. Internal and external structure of fishes, their systematic and ecological relationships, and their distribution in time and space. (*Dissection kit required.*)
258. *Mammalogy*. II. 3 hr. PR: Biol. 103 or W. Man. 224 and consent. Mammals and their biological properties with emphasis on life history, ecology, and distribution of regional forms.
259. *General Parasitology*. II. 4 hr. PR: Biol. 1 and 2 or equiv. Introduction to the biology of parasites. (*Dissection kit required.*)
260. *Plant Development*. I. 4 hr. PR: Biol. 102, organic chemistry or biochemistry, or consent. Experimental studies of plant growth and development.
261. *Comparative Anatomy*. I. 4 hr. PR: Biol. 1 and 2 or consent. A functional and evolutionary study of vertebrate structure. (*Dissection kit required.*)
262. *Vertebrate Embryology*. II. 4 hr. PR: Biol. 1 and 2 or consent. An experimental and descriptive analysis of vertebrate development.
263. *Vertebrate Microanatomy*. II. 5 hr. PR: Biol. 261 and consent. Structural and functional approach to the study of tissues and organs of vertebrates.
265. *Comparative Neuroanatomy*. I. 4 hr. PR: Biol. 261 and consent. Comparative study of development and anatomy of the nervous systems of the vertebrates. (*Dissection kit required.*)
266. *Human Physiology*. I, II, S. 4 hr. PR: Biol. 1 and 2 or consent. Introductory course in the function of man.
268. *Physiology of the Endocrines*. I, S. 3 hr. PR: Biol. 266, or equiv., Ag. Bi. 210 or consent. Regulation of the organs of internal secretions, and mechanisms of action of the hormones produced.
269. *Physiology of the Endocrines — Laboratory*. I. 1 hr. PR or Conc.: Biol. 268. Experimental techniques used in study of the endocrine system. (*Course will not be offered in 1981-82.*)
309. *Topics and Problems in Biology*. I, II, S. 1-4 hr. PR: Consent. Topics and problems in contemporary biology, to be selected in consultation with instructor.
311. *Biology Seminar*. I, II. 1 hr. Discussions and presentations of general interest to biologists.

315. *Molecular Basis of Virology*. I. 3 hr. PR: Biol. 104 or consent. Lectures on bacterial, animal, and plant viruses; their structure, replication, and interaction with host cells. Discussion of the contributions virology has made to the understanding of molecular mechanisms in biology.
331. *Sociobiology*. I. (Alternate Years.) 3 hr. PR: Biol. 231 or equiv. Concepts in biological bases of social behavior in animals. Emphasis is on the evolution of sociality and the principles underlying social interactions.
340. *Ecosystem Dynamics*. I. 3 hr. PR: Biol. 103 or equiv. Studies of modern approaches to ecosystem analysis. Emphasis will be on energy and material transfers. Approach will be holistic.
345. *Fisheries Science*. II. 4 hr. Biol. 257 or consent. Population dynamics in relation to principles and techniques of fish management. (Offered in Spring of odd years.)
346. *Production Limnology*. II. 3 hr. PR: Biol. 103 or 246 or equiv. Production in fresh-water ecosystems. Emphasis will be on methodology and results of research. Both primary and secondary production dynamics will be discussed.
350. *Biosystematics*. I. 3 hr. PR: Biol. 1 and 2 or equiv. Techniques, history and principles of the systematics of plants and animals. (Offered in Fall of odd years.)
351. *Plant Morphology (Algae and Fungi)*. II. 4 hr. PR: Biol. 1 and 2 or equiv. Development and structure of algae and fungi. (Offered in Spring of even years.)
352. *Plant Morphology (Bryophytes and Vascular Plants)*. II. 4 hr. PR: Biol. 1 and 2 or equiv. Development and structure of bryophytes and vascular plants. (Offered in Spring of odd years.)
354. *Fresh-Water Algae*. I. 4 hr. PR: Biol. 1 and 2 or equiv. Taxonomy, cytology, and ecology of aquatic, aerial, and land forms of fresh-water algae. (Offered in Fall of even years.)
355. *Advanced Plant Systematics I*. II. 3 hr. PR: Biol. 151 or equiv. Taxonomy of pteridophytes, gymnosperms, and monocotyledons. (Offered in Spring of odd years.)
356. *Advanced Plant Systematics II*. II. 3 hr. PR: Biol. 151 or equiv. Taxonomy of dicotyledons. (Offered in Spring of even years.)
358. *Field Studies of Invertebrates*. S. 3 hr. PR: Biol. 1 and 2 or equiv. Taxonomy and ecology of the invertebrates.
359. *Field Studies of Vertebrates*. S. 3 hr. PR: Biol. 1 and 2 or equiv. Taxonomy and ecology of the vertebrates.
362. *Developmental Biology*. I. 4 hr. PR: Biol. 101, 102, 262 or equiv. and organic chemistry. The molecular and cellular basis of differentiation and morphogenesis. (Offered in Fall of even years.)
364. *Advanced Plant Physiology*. I, II. 3 hr. PR: Biol. 169 or equiv., organic chemistry, general physics, and consent. Advanced studies of plant processes including recent advances in the field. I. Spring semester, odd-numbered years — Water relations and mineral nutrition and translocation. II. Fall semester, odd-numbered years — Plant growth and development. III. Spring semester, even-numbered years — Environmental physiology.
365. *Environmental Physiology*. II. 4 hr. PR: Biol. 101 or consent. Physiological mechanisms by which organisms adapt to their environments, comparing adaptations of phyletically different organisms to similar environments and the adaptations of similar organisms to different environments. (Offered in Spring of even years.)

443. *Advanced Plant Ecology*. II. 2-4 hr. PR: Biol. 103 and 243 or equiv. Advanced field studies in plant ecology. (Offered in Spring of even years.)
497. *Research*. I, II, S. 1-15 hr.

BIOMEDICAL SCIENCES — MARSHALL UNIVERSITY

Frederick J. Lotspeich, *Chairperson of the Department*

Marshall University Medical Center, 1801 6th Ave., Huntington, WV 25701

Degree Offered: Ph.D.

Graduate Faculty: Members Aserinsky, Belsha, Gilmore, Guyer, Hahn, Hill, Kasvinsky, Lotspeich, Moat, Mufson, Robinson, Watkins, and G. L. Wright. Associate Members Fenger, J. Foster, Moore, and Rankin.

Marshall University, under the auspices of West Virginia University, offers a Ph.D. in Biomedical Sciences. It offers advanced educational and research opportunity for those who desire to enter into, or advance in, biomedical science careers. Further information can be obtained from the graduate schools at West Virginia University or Marshall University.

BUSINESS ADMINISTRATION

Jay H. Coats, *Director of the Graduate Program*

302 Armstrong Hall

Degree Offered: M.B.A.

Graduate Faculty: Members Haas, Isaack, Montgomery, Schaupp, Tuchi, and Turner.

Associate Members Coats, Harpell, Hooper, Hughes, Logar, Mansour, Maust, Neidermeyer, Price, Riley, G. S. Smith, Tuberoso, and Twomey.

To obtain approval for entry into the Master of Business Administration (M.B.A.) program an applicant must have a baccalaureate degree from an accredited college or university with an undergraduate grade-point average of at least 2.75 (of a possible 4.0.) In addition, the applicant is required to submit an acceptable score on the Graduate Management Admission Test (GMAT.) A minimum score of 450 is satisfactory for applicants who have an undergraduate grade-point average of at least 3.0. A lower grade-point average will require a higher GMAT score. In exceptional cases, a student with a grade-point average between 2.25 and 2.75, or a student who has not taken the GMAT, may be admitted on a Special-Provisional basis.

To assure that all students in the program have the same foundation in business, the following prerequisite courses, or their equivalent, must be completed before enrolling in M.B.A. graduate courses: Principles of Accounting (two semesters), Principles of Economics, Principles of Management, Principles of Marketing, Corporate Finance, Legal Environment of Business, Statistics, and Computer Science.

A student without the necessary prerequisite courses may be approved to enter the M.B.A. program as a Regular Graduate Student with Deficiencies. The deficiencies must be removed before taking the required graduate courses. All applications for approval to enter the M.B.A. program must be received in the WVU Office of Admissions and Records as early as possible and no later than one month before the date for which enrollment is requested.

Master of Business Administration (M.B.A.)

The candidate's program of courses will be planned with the assistance and approval of a faculty adviser. The M.B.A. degree program requires 36 hours of graduate credit, including the following courses:

- Accounting 301 — Managerial Control, 3 hr.
- Economics 301 — Managerial Economics, 3 hr.
- Management 301 — Organizational Theory, 3 hr.
- Management 497 — Business Research Methods, 3 hr.
- Management 323 — Administrative Policy, 3 hr.
- Finance 313 — Corporate Financial Administration, 3 hr.
- Marketing 313 — Marketing Administration, 3 hr.

In addition, the student must take two of the following four courses as determined by the Director of Graduate Programs in Business and based upon the student's academic background:

- Management 302 — Quantitative Business Analysis, 3 hr.
- Management 310 — Methodology of Management Science, 3 hr.
- Management 311 — Management Information Systems, 3 hr.
- Management 313 — Production Administration, 3 hr.

(Students at the Off-Campus locations must take Management 302 and Management 313.)

The candidate also will complete 9 semester hours of elective courses selected with the approval of the adviser, of which at least 6 hours must be in a graduate course of the College of Business and Economics at the 300 level.

Students at the Morgantown campus may elect to take concentrations in the following areas: accounting, finance, management, management science, marketing or computer science. A concentration will include at least 12 semester hours of course work in the specialized area of study. Depending on the student's background, some concentrations may require a program of study in excess of 36 semester hours.

The M.B.A. program requires that the student maintain a grade-point average of at least 3.0 on all work taken as a graduate student while enrolled in the College, including prescribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.75 will be placed on probation. If the average is not brought up to 2.75 by the end of the following semester, the student will be suspended from this program. A grade below C in any course taken while enrolled as a graduate student will result in suspension from this graduate program. In addition, the student must maintain a 3.0 average in all work counting toward the graduate degree.

Complete information about the M.B.A. program may be obtained by securing a copy of the M.B.A. bulletin from the Director of Graduate Programs in Business.

The College of Business and Economics offers a Doctor of Philosophy degree in economics, with concentrations in either management or marketing. For a complete description of this program option refer to the Ph.D. degree options under the Department of Economics.

Accounting (Acctg.)

(For a complete listing of Accounting courses, see Professional Accountancy program, pages 276-277.)

301. *Managerial Control*. 3 hr. PR: Acctg. 52. Use and significance of quantitative techniques of accounting, statistics, and budgeting for planning, and decision making.

Business Law (B. Law)

- 200. *Special Topics. I, II, S. 1-4 hr. PR: B. Law 112 or consent.* Special topics relevant to business law. Maximum of 9 semester hours in any or all courses numbered 200 offered by the College of Business and Economics may be applied toward bachelor's and master's degrees.
- 211. *Personnel Relations and the Law. I, II. 3 hr.* An overview of the legal principles guiding employer-employee relations, including agency law and the law regulating employee health, safety, compensation and benefits, job opportunity, and labor organizing.
- 491. *Advanced Study. 1-6 hr.*

Economics (Econ.)

- 301. *Managerial Economics. II. 3 hr. PR: Econ. 54.* For students in the M.B.A. program. Analysis of markets and problems of management in appraising business conditions and in adjusting to changes in product demand, costs, level output, and profits.

Finance (Fin.)

- 200. *Special Topics. I, II, S. 1-4 hr. PR: Fin. 111 or consent.* Special topics relevant to finance. Maximum of 9 semester hours in any or all courses numbered 200 offered by the College may be applied toward bachelor's and master's degrees.
- 216. *Risk Management. II. 3 hr. PR: Fin. 115 or consent.* Transferable risks with which the entrepreneur must deal. Emphasis on the process by which decisions are made for handling these risks, including an examination of contributions and limitations of insurance system.
- 220. *Social Insurance. I. 3 hr.* A study of our social and political efforts to provide economic security for the general public. The course includes an examination of the parallel developments of private insurance.
- 250. *Security Analysis and Portfolio Management. II. 3 hr. PR: Fin. 150 or consent.* The systematic selection, assessment, and ranking of corporate securities in a portfolio framework through a synthesis of fundamental analysis, technical analysis, and random walk.
- 251. *Bank Management. II. 3 hr. PR: Fin. 111.* Study of the management of commercial bank funds. Examination of the principles applicable to the various types of lending and investing within legal restraints of government.
- 261. *Real Estate Appraising. 3 hr. PR: Fin. 161.* This course will define the appraisal problem, plan the approach, acquire, classify, analyze and interpret data into an estimate of value by the use of the cost or replacement approach, income approach and market approach.
- 262. *Real Estate Finance. 3 hr. PR: Fin. 111, 161.* This course is designed to show how financing, the tax system, and supply and demand interact to create values which, when coupled with investment decision, leads to choosing an investment strategy in real estate.
- 263. *Real Estate Investments/Land Development. 3 hr. PR: Fin. 161.* Designed to investigate various types of real estate investments including apartments, office buildings, shopping centers, and residential land developments with emphasis on financial analysis, profitability analysis, and rates of return.
- 299. *Independent Study. I, II, S. 1-3 hr. PR: Consent.* Students will develop and complete a program of specialized studies under the supervision of a cooperating instructor.

313. *Corporate Financial Administration*. I, II. 3 hr. PR: Fin. 111. A study of theoretical concepts of corporate financial administration and the application of these concepts to real world case studies.
315. *Money and Capital Markets*. II. 3 hr. PR: Fin. 111. Advanced study of money and capital markets, institutions involved, effect of monetary and fiscal policies on private finance, and detailed study of major managerial problems of financial institutions.
317. *Capital Budgeting*. S. 3 hr. PR: Fin. 111. Advanced study in modern techniques and theory of the capital budgeting process. Emphasis is placed on the application of quantitative models and the methods of handling risk.
329. *Seminar in Finance*. 3 hr. PR: Fin. 313.
491. *Advanced Study*. 1-6 hr.

Management (Manag.)

200. *Special Topics*. I, II, S. 1-4 hr. PR: Manag. 105 or consent. Special topics relevant to management. Maximum of 9 semester hours in any or all courses numbered 200 offered by the College may be applied toward bachelor's and master's degrees.
201. *Business Information Systems*. I, II. 4 hr. PR: Manag. 105, Fin. 111, Mrktg. 111, Acctg. 52, Com. S. 5. An introduction to the use of EDP for management control and decision making with emphasis on application in the functions of finance, marketing, personnel, accounting, and operations management. 3 hr. lec., 3 hr. lab.
205. *The Individual and the Organization*. II. 3 hr. Examination of how the individual, the group, and the organization interact to influence the behavior of the business organization and that of its human resources.
206. *Organizational Theory and Analysis*. II. 3 hr. PR: Manag. 205 or consent. Influences of structure on the behavior and dynamics of the business organization. Attention on how to be an effective manager.
210. *Business Decision-Making Under Uncertainty*. II. 3 hr. PR: Manag. 112 or Com. S. 5. and Manag. 111. Analysis of business problems where certainty does not exist. The case approach with actual or realistic data involving more than one business functional area. Solution of unique business problems.
213. *Problems in Business Administration*. I, II, S. 1-3 hr. Selected management problems related to the total enterprise and the emerging technostructure, e.g., managerial and corporate strategy, utilization of resources, social responsibility and government relations, dynamics of new industries.
216. *Personnel Management*. I, II. 3 hr. Systematic study about leading and motivating people whose work behavior is influenced by technology, organization, and management style as those affect the individual and one's work groups. Problems in obtaining, developing, maintaining, and directing human resources for an organization.
217. *Personnel and Compensation*. I, II. 3 hr. PR: Manag. 216. This course provides the knowledge to design and implement total compensation systems in both private and public sectors. The emerging elements of total compensation systems are included providing insights into problems and opportunities for personnel.
218. *Focal Points in Management*. I, II. 1-3 hr. PR: Manag. 105. In-depth study of specialized management subjects, e.g., personnel interviewing, job descriptions, consulting, or organizational development. (Each subject is self-contained, spans one-third of a semester, and is valued at 1 credit hour.)

220. *Deterministic Decision Analysis*. I. 3 hr. PR: Manag. 112. Study and application of quantitative methods to business problems in which deterministic conditions prevail.
225. *Business Policy*. I, II. 3 hr. PR: Senior standing and consent. Integrated study of policies, organization, facilities, and control techniques of business enterprises.
230. *Entrepreneurship*. I, II. 3 hr. PR: Manag. 160. The role of the entrepreneur in business and society; includes an analysis of the individual entrepreneur, and investigates the nature and problems of establishing a new business enterprise.
260. *Practicum in Small Business*. I, II. 3 hr. PR: Manag. 160. A practical training ground in the identification and solution of small business problems. Through interaction with the business community, students are exposed to the opportunities and difficulties of small business entrepreneurship.
299. *Independent Study*. I, II, S. 1-3 hr. PR: Consent. Students will develop and complete a program of specialized studies under the supervision of a cooperating instructor.
301. *Organizational Theory*. 3 hr. PR: Manag. 105 or consent. Interpersonal relationships through which administration becomes effective. Emphasis on human factors, but influences of economic and technological factors also are considered. Focus on importance of harmony between individual needs and organization goals.
302. *Quantitative Analysis of Business Data*. I, II. 3 hr. PR: Manag. 105, Mrktg. 111, Fin. 111, Econ. 125, Com. S. 5 or Com. S. 301, or consent. Integrating business functional knowledge and quantitative tools by case method. Emphasis on analysis of realistic business data.
305. *Organizational Development*. II. 3 hr. Emphasis on using knowledge of the behavioral science to aid organizations in adjusting to changing environments. A systems view is employed in order to simultaneously consider organizational structure, environment and climate, and social awareness.
310. *Methodology of Management Science*. I. 3 hr. PR: Manag. 105, Mrktg. 111, Fin. 111, or consent. Philosophy, methodology, and applications of management science to decision-making in business functional areas. Extensive use of cases and projects to integrate topical material with the functional areas of management, marketing, and finance.
311. *Management Information Systems*. II. 3 hr. PR: Com. S. 5 or Com. S. 301 or consent. This course examines computer technology, computer applications, information systems, performance, computer system planning, selection, implementation, and computer impacts upon management, organization and society — from a managerial perspective rather than a computer specialist's.
313. *Production Administration*. 3 hr. PR: Com. S. 1 or 301. Review and application of analytical techniques to complex manufacturing problems.
316. *Advanced Personnel Management*. II, S. 3 hr. PR: Manag. 216. In-depth treatment of the art in personnel and psychology; emphasis on six interrelated topics; contemporary issues, applied measurement concepts for personnel decisions, strategy and structure, selection and training of personnel.
323. *Administrative Policy*. 3 hr. PR: Consent. An integrated study of policies, organization, facilities, and control techniques of business enterprises.
329. *Seminar in Management*. 3 hr.
491. *Advanced Study*. 1-6 hr.
497. *Research*. I, II, S. 1-15 hr.

Marketing (Mrktg.)

- 200. *Special Topics*. I, II, S. 1-4 hr. PR: Mrktg. 111 or consent. Special topics relevant to marketing. Maximum of 9 semester hours in any or all courses numbered 200 offered by the College may be applied toward bachelor's and master's degrees.
- 201. *Focal Points in Marketing*. I. 1-3 hr. PR: Mrktg. 111. In-depth study of specialized marketing subjects, e.g., franchising, tourism, packaging, or product development. Each subject is self-contained, spans one-third of a semester, and is valued at 1 credit hour.
- 203. *Sales Management*. II. 3 hr. PR: Mrktg. 200. Concentrates on the managerial responsibilities of sales managers for directing, motivating, and controlling a sales force plus the techniques of selling including handling objections and closing.
- 205. *Consumer Behavior*. II. 3 hr. PR: Mrktg. 111. The nature of the consumer decision process in a marketing framework. Emphasis on the psychological and sociological concepts which influence the decision process.
- 207. *Business Logistics Management*. I, II. 3 hr. PR: Mrktg. 115. Introduction to the field through examination of transportation, warehousing, materials handling, containerization, inventory control, purchasing, and warehouse location. Significant use made of problem solving with analytical tools.
- 210. *Industrial Markets*. I. 3 hr. PR: Mrktg. 111; Coreq.: Mrktg. 211 or consent. A study of marketing to three classes of customers: the industrial market, the institutional market, and governmental agencies.
- 211. *Marketing Management*. I, II. 3 hr. PR: Mrktg. 111, 12 hr. of marketing or consent. An approach to executive marketing decision making. Simulation through live and written case study should sharpen skills as the student makes analytical evaluations of marketing problems.
- 299. *Independent Study*. I, II, S. 1-3 hr. PR: Consent. Students will develop and complete a program of specialized studies under the supervision of a cooperating instructor.
- 313. *Marketing Administration*. I, II. 3 hr. PR: Mrktg. 111. Analysis of problems met by management in distributing goods and services efficiently to consumers.
- 314. *Management of Product Development*. II. 3 hr. PR: Mrktg. 313. An advanced analysis of the problems in the conceptualization, developing, and marketing of new products with emphasis on what to develop, how to develop, and how to market.
- 315. *Management of Distribution Systems*. S. 3 hr. PR: Mrktg. 313. Advanced analysis of the design and operations of distribution systems. Topics include distribution channel selection, administration and control; demand forecasting, facility location, choice and scheduling of transport, and the allocation and control of inventories.
- 329. *Seminar in Marketing*. 3 hr.
- 491. *Advanced Study*. I, II. 1-6 hr.

CHEMICAL ENGINEERING

C. Y. Wen, Chairperson of the Department

425 Engineering Sciences Building

Degrees Offered: M.S.Ch.E., M.S.E., Ph.D.

Graduate Faculty: Members Bailie, Blackshaw, Henry, Sears, Verhoff, and Wen. Associate Members Cilento, Galli, Ludlow, and Riggs.

The Department of Chemical Engineering is one of the oldest established departments in the College of Engineering and was the first to offer a doctoral

program at WVU. The department has maintained a high degree of stability within its structure over the years, affording the faculty an atmosphere conducive to cooperation, inventiveness, and productivity. It is for these reasons that the department has achieved national recognition as a leader in chemical engineering education and is known nationally and internationally for its research efforts and accomplishments.

The graduate education program in chemical engineering includes traditional instruction in advanced chemical engineering coupled with exposure to relevant technological problems on the forefronts of engineering science. The department's research goals are to provide engineering assistance in meeting current and future problems faced by the nation. To accomplish these objectives, the department has recruited some of the finest faculty expertise available, particularly in the areas of energy production and related processes. Achievements in the areas of fluidized bed combustion, coal gasification, biomass conversion, ultrasonics, and separation processes are internationally recognized. New areas currently being developed within the department, such as secondary oil recovery, solar energy, and biomedical engineering, are certain to reach a similar status in the near future.

Excellent rapport exists in the department between faculty and students, as well as with colleagues in education and industry, producing a cooperative atmosphere for approaching educational and research problems. Every senior professor has authored, co-authored, or been a major contributor in the writing of at least one textbook or an upper division reference book. In addition, several faculty members have written short-courses or workshop texts currently used at other universities or at national conferences. During the last ten years, the Chemical Engineering faculty has authored or co-authored twelve books, published more than 180 referred journal articles, has been issued four patents, presented 170 seminars or lectures as invited speakers, and has supervised the completion of 56 master's and 24 doctoral degrees.

Master of Science in Chemical Engineering (M.S.Ch.E.)

Master of Science in Engineering (M.S.E.)

Students must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. The master's degree programs, as outlined in "A Guide to the Graduate Program in Engineering," are offered and administered by the Department of Chemical Engineering.

Normally all M.S. degree candidates are required to perform research and will follow a planned program which conforms to either of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.

2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.

Admission to the M.S.Ch.E. program is restricted to those holding a baccalaureate degree in chemical engineering or its equivalent. In unusual cases the faculty will consider a student petition to take a 36-hour design-oriented chemical engineering practice program.

The M.S.E. program is available to students holding baccalaureate degrees in other fields of engineering and the physical sciences who wish to pursue a broad interdisciplinary program relevant to the major graduate areas administered by the department.

M.S. candidates should expect to obtain their degree in about one calendar year with an upper limit of 18 months.

Courses. The adviser, in conjunction with an advisory and examining committee to be assigned to each student, will be responsible for following departmental guidelines to determine specific courses appropriate to the student's program. These departmental guidelines are available on request.

Examination. A candidate shall be required to pass examinations which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the program selected.

Doctor of Philosophy (Ph.D.)

A candidate for the degree of Doctor of Philosophy in the Interdisciplinary Ph.D. program must comply with the rules and regulations as outlined in "A Guide to the Graduate Program in Engineering" and the Graduate School, and any specific regulations required by the Department of Chemical Engineering. A program with a major in chemical engineering, designed to meet the needs and objectives of each student, will be developed in consultation with the student's adviser and advisory and examining committee.

Students entering the Ph.D. program after obtaining a master's degree should receive their Ph.D. degree in two or three additional years. Students that go directly for a Ph.D. degree after undergraduate school receive their degree in a maximum of four years. The research work for a doctoral dissertation should show a high order of originality on the part of the student and must offer an original contribution to the field of engineering science.

Chemical Engineering (Ch. E.)

- 224. *Process Development.* 3 hr. PR: Chem. 134, 144. Ch. E. 111 and 143, or consent. Coal conversion process systems from the modified unit operations-unit process concept. Thermodynamics and kinetics in evaluation of system requirements and performance. 3 hr. rec.
- 231. *Mathematical Methods in Chemical Engineering.* 3 hr. PR: Math 18. Classification and solution of mathematical problems important in chemical engineering. Treatment and interpretation of engineering data. Analytical methods for ordinary and partial differential equations including orthogonal functions and integral transforms. 3 hr. rec.
- 238. *Process Modeling.* 3 hr. PR: Math. 16, Ch. E. 41, or Conc.: Ch. E. 41. Analysis of engineering equations, process material balances. Computer programming — BASIC, numerical analysis. 2 hr. rec., 2 hr. lab.
- 251. *Metallurgical Engineering.* 3 hr. PR: Physics 12. Principles of production of metals and alloys, plastic deformation of metals, corrosion, and metal failure. 3 hr. rec. (Course will not be offered in 1981-82.)
- 253. *Ceramic Engineering I.* 3 hr. PR: Physics 12. Characterization of ceramic systems. Study of internal structure sensitive properties; liquid and solid solutions; rheology; mechanical, thermal, chemical, optical, and electrical properties. 3 hr. rec. (Course will not be offered in 1981-82.)
- 258. *Polymers and Polymer Technology.* 3 hr. PR or Conc.: Chem. 134. Polymers and their handling. Properties of macromolecules as influenced by molecular weight, polymerization methods, plastics technology, polymer engineering. 3 hr. rec.
- 270. *Strategy of Process Engineering.* 3 hr. PR: Ch. E. 111 or consent. Latest theories of process design and process optimization, proven through regular use by practicing

engineers, are applied to the major problems of process engineering. 3 hr. rec. (Course will not be offered in 1981-82.)

280. *Chemical Engineering Problems*. 1-6 hr. For juniors, seniors, and graduate students. May be used to correct deficiencies preparatory to or following courses such as Ch. E. 170 and 171, or for students in other disciplines desiring to take only a portion of a course.
290. *Introduction to Nuclear Engineering*. 3 hr. PR: Junior standing. Introduction to fundamental principles and applications of nuclear technology in science and engineering fields. Studies of nuclear fission and the design and operation of nuclear reactor systems; uses of radioisotopes as power sources and in materials processing, testing, and medicine; health physics and radiation detection and shielding.
301. *Transport Phenomena*. 3 hr. PR: or Conc.: Ch. E. 231, or equiv. Introduction to equations of change (heat, mass and momentum transfer) with a differential balance approach. Use in Newtonian flow, turbulent flow, mass and energy transfer, radiation, convection. Estimation of transport coefficients. 3 hr. rec.
307. *Distillation*. 2-5 hr. PR: Math. 18 and consent. Vaporization principles of separation of liquid mixtures, stream, batch, continuous, azeotropic, extractive, and molecular distillation. 3 hr. rec., 0-6 hr. lab. (Course will not be offered in 1981-82.)
323. *Advanced Process Development*. 3 hr. PR: Consent. Extended and generalized unit process and operation concepts; specialized synthetic methods; reaction mechanisms and their effects on equipment design and performance; properties, their evaluation, prediction and marketability; industrial toxicology and plant safety. 3 hr. rec.
330. *Process Dynamics and Control*. 3 hr. PR: Consent. Dynamic response of processes and control instruments. Use of Laplace transforms and frequency response methods in analysis of control systems. Application of control systems in chemical reactors, distillation, and heat transfer operations. Introduction to non-linear systems. 3 hr. rec.
344. *Thermodynamics*. 3 hr. PR: Consent. Logical development of thermodynamic principles. These are applied to selected topics including development and application of the phase rule, physical and chemical equilibria in complex systems, and non-ideal solutions. Introduction to non-equilibrium thermodynamics. 3 hr. rec.
345. *Chemical Reaction Engineering*. 3 hr. PR: Consent. Homogeneous reactions, batch and flow reactors, ideal reactors, macro and micro mixing, non-ideal flow reactors, heterogeneous reaction systems, catalytic and non-catalytic reactions, reactor stability analysis, reactor optimization. 3 hr. rec.
358. *Polymer Processing*. 3 hr. PR: Chem. 134 or consent. Analytical description of rheology, molding, extrusion, bonding, polymer modification operations, physical properties. 3 hr. rec. (Course will not be offered in 1981-82.)
370. *Process Equipment Design. I*. 3 hr. PR: Ch. E. 301 or consent. Design, sizing, optimization, and cost estimation of equipment used for heat transfer, and emphasis on design techniques; computer design techniques discussed where applicable.
371. *Process Equipment Design. II*. 3 hr. PR: Ch. E. 301 or consent. Design and selection of separation processes including crystallization, leaching, extraction, distillation, absorption, filtration, membrane, and diffusional separation processes. Similarities between separation processes based on mode of operation are emphasized. 3 hr. rec.
390. *Nuclear Reactor Systems I*. 3 hr. PR: Consent. Intended as a first course for graduate students in the area of power reactor systems analysis and design. Includes topics such as neutron interactions with reactor materials, fission, reactor physics, reactor heat generation and removal, and thermal reactor core design.

391. *Nuclear Reactor Systems II*. 3 hr. PR: Ch. E. 390. Continuation of Ch. E. 390. Reactor kinetics, nuclear power economics, and case studies and analyses of the following reactor systems: pressurized-water, boiling-water, fast breeder, and gas-cooled power plants.
392. *Interaction of Radiation and Matter*. 1-3 hr. PR: Consent. Types of radiation, energy deposition by radiation, experimental instrumentation, formation and reactions of radiation-chemical species. 1-3 hr. rec. (Course will not be offered in 1981-82.)
400. *Chemical Engineering Seminar*. 1-6 hr. Fluidization, bioengineering, transport phenomena for biological systems, air and water pollution abatement, fast-reaction kinetics, radiation, nuclear power engineering, and direct energy conversion.
402. *Advanced Fluid Dynamics*. 3 hr. PR: Consent. Analysis of flow of fluids and transport of momentum and mechanical energy. Differential equations of fluid flow; potential flow, flow in porous media, laminar boundary layer theory, and non-Newtonian fluids. 3 hr. rec.
404. *Advanced Heat Transfer*. 3 hr. PR: Consent. Theory of transport of thermal energy in solids and fluids as well as radiative transfer. Steady and transient conduction; heat transfer to flowing fluids; evaporation; boiling and condensation; packed and fluid bed heat transfer. 3 hr. rec.
406. *Advanced Mass Transfer*. 3 hr. PR: Consent. Theory of diffusion, interphase mass transfer theory, turbulent transport, simultaneous mass and heat transfer, mass transfer with chemical reaction, high mass transfer rates, multicomponent macroscopic balances. 3 hr. rec.
432. *Optimization of Chemical Engineering Systems*. 3 hr. PR: Consent. Optimization in engineering design, unconstrained optimization and differential calculus equality constraints optimization, search technique, maximum principles, geometric and dynamic programming, linear and non-linear programming, calculus of variations. 3 hr. rec.
446. *Catalysis*. 3 hr. PR: Ch. E. 345 or consent. Physical and chemical properties of catalytic solids, nature and theories of absorption, thermodynamics of catalysis, theories of mass and energy transport, theoretical and experimental reaction rates, reactor design and optimization. 3 hr. rec.
447. *Non-Catalytic Solid-Fluid Reactions*. 3 hr. PR: Ch. E. 345 or consent. Reaction models, pseudo-steady approximation, effectiveness factor, transport and chemical reaction properties, geometric, thermal and transitional instabilities, simultaneous multiple reactions, selectivities in fixed, moving and fluidized bed reactor design. 3 hr. rec.
472. *Process Design and Development*. I. 3 hr. PR: Ch. E. 301 or consent. Process development, from inception to the final design, emphasis on economic and cost estimating at various stages of process development, relationship of research and development, engineering design and production, process optimization and computer design techniques. 3 hr. rec.
473. *Process Design and Development*. II. 3 hr. PR: Ch. E. 472 or consent. Practice of process design using case studies method either with class or student teams, concurrent lectures on relevant subjects taught by specialists using team teaching concepts. 3 hr. rec.
480. *Advanced Independent Study*. 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of chemical engineering.
497. *Research*. 1-15 hr.

(See Eng. 260 under General Engineering in Part 5.)

CHEMISTRY

George L. Humphrey, Associate Chairperson of the Department
309 Clark Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Cherry, Dalal, Fodor, Hall, Hickman, Humphrey, MacDowell, Moore, Muth, Nakon, Paul, Peterson, Showalter, Stein, Strohl, and Winston. Associate Member Smart.

The Department of Chemistry offers graduate studies leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) with research concentration in the areas of analytical, inorganic, organic, physical, and theoretical chemistry. The Master of Science and Doctor of Philosophy degrees require completion of a research project which represents the principal theme about which the graduate program is constructed.

Applicants for graduate studies in chemistry must have a bachelor's degree as a minimum requirement. Applicants for the M.S. program must have a major or concentration in chemistry and an appropriate background in physics and mathematics. All entering graduate students in chemistry are required to take Departmental Guidance Examinations in the major areas of chemistry. These examinations, on the undergraduate level, are administered before registration and serve to guide the faculty in recommending a course program for the beginning graduate student. Deficiencies revealed on the Guidance Examinations need to be corrected in a manner prescribed by the faculty.

The general Graduate School requirements for the Master of Science degree are outlined in the *Graduate School Catalog*. Graduate students in the M.S. program in chemistry are required to submit a research thesis. They may apply up to 6 hours of research credit toward the Graduate School 30-hour requirement. The remaining 24 hours of credit must be earned in the basic graduate courses which reflect a diversified exposure to chemistry; no more than 10 hours may be elected outside the department. A final oral examination is administered after completion and submission of the thesis.

The program for the degree of Doctor of Philosophy reflects a flexible, research-oriented approach geared to develop the interests, capability, and potential of mature students. A program of courses is recommended to suit individual needs based on background, ability, and maturity. These courses are classified as basic graduate courses which present the essentials of a given discipline on an advanced level, and specialized graduate courses which take one to the frontiers in a specific area of research. The course offerings are designed to provide guidelines from which students can launch their independent studies in preparation for candidacy examinations. Students are required to enroll in the departmental seminar program and are expected to attend special lectures and seminars offered by visiting chemists.

All graduate students in the Ph.D. program are expected to achieve a certain diversified background in the major areas of chemistry. In order to aid in this achievement, a departmental distribution requirement must be met of one course in each of the four major areas of chemistry to be selected from a list of course offerings approved by the department. In addition, each major area in chemistry requires students in the discipline to enroll in basic graduate courses which present the essentials of that discipline on an advanced level.

Candidacy examinations consist of both a written and oral portion. The written examinations are of the cumulative type, and are offered eight times a

year. The oral examination is based on a proposition for a research problem not intimately related to the student's own problem, or any particular research problem being actively pursued at WVU. This proposition is presented in writing to the student's research committee and defended before that group and any other interested faculty members.

Each candidate for the Ph.D. must satisfy a departmental language requirement in a language approved by the student's research committee.

Research, which is the major theme of graduate studies, may be initiated as early as the student and faculty feel appropriate for each individual case. Normally, a student will begin laboratory work no later than the second semester. Upon successful completion of an original piece of research, the candidate will present results in a Ph.D. dissertation and at the appropriate time defend the work in a final oral examination.

Chemistry (Chem.)

Note: A charge is made for excessive breakage in laboratory courses and for failure to return desk equipment when leaving laboratory courses.

201. *Chemical Literature*. II. 2 hr. PR: Chem. 131 or 134. Study of techniques of locating, utilizing, and presenting information needed by the research workers in chemistry. 2 hr. lec.
202. *Selected Topics*. I, II. 1-3 hr. (May be repeated for credit.) PR: Written consent, with at least a 2.0 grade-point average in chemistry courses. Individual instruction under supervision of an instructor.
210. *Instrumental Analysis*. II. 3 hr. PR: Chem. 246. Basic instrumentation of analytical measurements. Electronics and instrument design. Methods of electrochemical and spectrochemical analysis. 2 hr. lec., 3 hr. lab.
211. *Intermediate Analytical Chemistry*. I. 3 hr. PR: Physical chemistry. Principles of analytical procedures and separations at an intermediate level. 3 hr. lec.
222. *Chemistry of Inorganic Compounds*. II. 3 hr. PR: Physical chemistry. Correlation of reactions and properties of elements and compounds based on modern theories of chemical bonding and structure. Acid-base theory, non-aqueous solvents, ligand field theory, and stereochemistry. 3 hr. lec.
235. *Methods of Structure Determination*. I. 4 hr. PR: Chem. 134 and 136. Use of chemical methods and u.v., ir., n.m.r., e.s.r., Raman and mass spectroscopy to elucidate structures of organic compounds. For students in chemistry and related fields who may need these methods in research and applied science. 2 hr. lec., two 3-hr. lab.
237. *Polymer Chemistry*. I or II. 3 hr. PR: Chem. 135 and Physical chemistry. Methods, mechanisms, and underlying theory of polymerization. Structure and stereochemistry of polymers in relation to chemical, physical, and mechanical properties. 3 hr. lec.
239. *Organic Syntheses*. II. 2 hr. PR: Chem. 136. Modern synthetic methods of organic chemistry. Two 3-hr. lab.
241. *Crystallography*. I or II. 3 hr. PR or Conc.: Physical chemistry or consent. Applications of X-ray diffraction of crystals to the study of crystal and molecular structure. Includes theories of diffraction and crystallographic methods of analysis. 3 hr. lec. (Course will not be offered in 1981-82.)
243. *Introduction to Radiochemistry and Radiation Chemistry*. I. 3 hr. PR or Conc.: Physical chemistry. Fundamentals of radiochemistry and the use of tracer techniques. An introduction to radiation chemistry and how ionizing radiation interacts with matter. 2 hr. lec., 3 hr. lab.

244. *Colloid and Surface Chemistry*. II. 3 hr. PR: Physical chemistry. Selected topics in the properties and physical chemistry of systems involving macromolecules, lyophobic colloids, and surfaces. 3 hr. lec.
246. *Physical Chemistry*. I. 3 hr. PR: Chem. 18 or 115, Math. 16, and Physics 12. A first course in physical chemistry. Topics include a study of thermodynamics and chemical equilibria. 3 hr. lec.
247. *Physical Chemistry Laboratory*. I. 1 hr. PR: Chem. 17, 18 or 115; PR or Conc.: Chem. 246. Experimentation illustrating the principles of physical chemistry and offering experience with chemical instrumentation. One 3-hr. lab.
248. *Physical Chemistry*. II. 3 hr. PR: Chem. 246 and Math. 17. Continuation of Chem. 246. Chemical dynamics and the structure of matter. 3 hr. lec.
249. *Physical Chemistry Laboratory*. II. 1-2 hr. PR: Chem. 246, 247, 248, or concurrent enrollment. Continuation of Chem. 247. Two 3-hr. lab.
250. *Chemical Bonding and Molecular Structure*. I. 3 hr. PR: Chem. 248. Introduction to the quantum theory of chemical bonding. Atomic structure, theoretical spectroscopy, predictions of molecular structures and bond properties. 3 hr. lec.
315. *Chemical Separations*. II. (Alternate Years.) 3 hr. PR: Chem. 115, 133, and Physical chemistry. Modern methods of chromatography from a theoretical and practical standpoint. General principles of separation stressing the practical implementation of these principles with particular emphasis on high performance liquid chromatography and gas chromatography. 3 hr. lec. (Course will not be offered in 1981-82.)
331. *Advanced Organic Chemistry I*. I. 3 hr. PR: Chem. 134. Structural concepts, bonding, tautomerism, static and dynamic stereochemistry, mechanistic classifications of reagents, and reactions including some applications. 3 hr. lec.
332. *Advanced Organic Chemistry II*. II. 3 hr. PR: Chem. 331. Continuation of Chem. 331 with emphasis upon synthetic methods and reaction mechanisms. 3 hr. lec.
341. *Chemical Thermodynamics*. I or II. 3 hr. PR: Chem. 248. Principles of classical and statistical thermodynamics and their application to chemical problems. 3 hr. lec.
- 411, 412. *Seminar in Analytical Chemistry*. I, II. 1 hr. per sem. Current literature and research.
413. *Electrochemistry and Instrumentation*. I or II. 3 hr. PR: Chem. 210. Electronic instrumentation applied to study of mass transfer, kinetics of electrode reactions, voltammetry, and high-frequency methods. 3 hr. lec.
414. *Spectroscopic Methods*. I or II. 3 hr. PR: Chem. 210. Problems in design of instruments for each of the various spectral regions. 3 hr. lec.
- 417, 418. *Advanced Topics in Analytical Chemistry*. I, II. 1-3 hr. per sem. Recent advances and topics of current interest.
- 421, 422. *Seminar in Inorganic Chemistry*. I, II. 1 hr. per sem. Current literature and research.
423. *Advanced Inorganic Chemistry*. I or II. 3 hr. PR: Chem. 222. Bonding theories, stereochemistry, non-aqueous solvent systems, physical methods and current topics. 3 hr. lec.
424. *Coordination Chemistry*. I or II. 3 hr. PR: Chem. 222. Ligand field theory, spectral interpretations, stability considerations, synthetic methods, unusual oxidation states, organometallic compounds, other topics of current interest. 3 hr. lec.
425. *Inorganic Reactions and Mechanisms*. I or II. 2 hr. PR: Chem. 222 and 443. Substitution, isomerization, racemization, and oxidation-reduction reactions. 2 hr. lec.

- 427, 428. *Advanced Topics in Inorganic Chemistry*. I, II. 1-3 hr. per sem. Recent advances and topics of current interest.
- 431, 432. *Seminar in Organic Chemistry*. I, II. 1 hr. per sem. Current literature and research.
433. *Physical Organic Chemistry*. I or II. 3 hr. PR: Chem. 331. Theoretical considerations of organic molecules, kinetics and other methods used in the study of organic structure and reaction mechanisms, linear free energy relationship and other related topics. 3 hr. lec.
436. *Heterocyclic Chemistry*. I or II. 3 hr. PR: Chem. 331. Major heterocyclic systems and discussion of selected natural products containing heterocycles. 3 hr. lec.
- 437, 438. *Advanced Topics in Organic Chemistry*. I, II. 1-3 hr. per sem. Recent advances and topics of current interest.
- 441, 442. *Seminar in Physical Chemistry*. I, II. 1 hr. per sem. Current literature and research.
443. *Chemical Kinetics*. I or II. 3 hr. PR: Chem. 248. Theories and applications of kinetics in gaseous state and in solution. 3 hr. lec.
444. *Statistical Mechanics*. I or II. 3 hr. PR: Chem. 446. Theory and application of statistical mechanics to chemical systems. 3 hr. lec. (Course will not be offered in 1981-82.)
445. *Theoretical Chemistry I*. I or II. 3 hr. PR: Differential equations. Theoretical background for quantum mechanics. 3 hr. lec.
446. *Theoretical Chemistry II*. I or II. 3 hr. PR: Chem. 445. Theories and applications of quantum mechanics in chemistry. 3 hr. lec.
447. *Molecular Spectroscopy and Structure*. I or II. 3 hr. PR: Chem. 250. Advanced applications of spectral methods to a study of molecular structure. 3 hr. lec.
- 448, 449. *Advanced Topics in Physical Chemistry*. I, II. 1-3 hr. per sem. Recent advances and topics of current interest.
490. *Teaching Practicum*. I, II. 1-3 hr. PR: Consent. Supervised practices in college teaching of chemistry.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
492. *Research Seminar*. I, II. 1 hr. PR: Graduate student in chemistry. Research seminars by visiting lecturers.
497. *Research*. I, II, S. 1-15 hr.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in academic and cultural programs.

CIVIL ENGINEERING

Fred W. Beaufait, *Chairperson of the Department*
 623 Engineering Sciences Building
Degrees Offered: M.S.C.E., M.S.E., Ph.D.

Graduate Faculty: Members Beaufait, Byrne, GangaRao, Head, Jenkins, Kemp, Luttrell, Moulton, Neumann, and Sack. Associate Members Collins, Eck, Eli, Halvorsen, Siriwardane, and Zagajeski.

The Department of Civil Engineering has a full-time faculty of 18, who are active in teaching, research, and professional commitments. There are four major areas of interest of the faculty and graduate studies:

1. Environmental engineering and water resources, which includes air pollution, occupational health, solid-hazardous waste management, water supply and pollution, ground water hydraulics, and hydrology.

2. Geotechnical and materials engineering, which covers soil mechanics, foundations engineering, soil-structure interaction, groundwater and seepage, and earthwork design, as well as construction materials and waste product utilization.

3. Transportation engineering, which includes transportation systems principles, design, and planning.

4. Structural engineering, which involves work and study in advanced structural analysis, bridge engineering, and building design.

With few exceptions, the members of the faculty are registered professional engineers in one or more states and are involved in state, regional, and national professional organizations, serving on numerous technical committees. They are successful researchers and have published extensively in various technical journals. The civil engineering faculty is concerned with more than the technical education of students — it is concerned with the development of a professional engineer; one who will be able to assume the role of a problem solver, decision maker, and technical leader, and one whose educational background will undergird the continuing development required during the engineer's professional career.

Each graduate student can tailor a program of study to satisfy the student's own special interest. Opportunities abound within the master's and doctoral programs for a research experience which provides a chance for a student to tackle an engineering problem individually, with guidance from a faculty adviser. The graduate program in civil engineering has been established with the philosophy of developing in the student the ability to use today's contemporary methods of engineering analysis and design so that they can solve tomorrow's engineering problems.

Master of Science in Civil Engineering

Master of Science in Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in "A Guide to the Graduate Program in Engineering." Each candidate will, with the approval and at the discretion of the graduate committee, follow a planned program which must conform to one of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.

2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.

3. A minimum of 36 semester credit hours, with no thesis or problem report required.

Courses. No rigid curriculum is prescribed for the degrees of Master of Science in Civil Engineering and Master of Science in Engineering. Graduate level work in mathematics, mechanics, or other appropriate areas of science is

customary; however, at least 15 semester hours of credit should normally be selected from graduate civil engineering courses.

Thesis or Problem Report. A thesis or problem report is normally required of all candidates. While required credit in research (C.E. 497) is devoted to the thesis or report preparation, the thesis or problem report is not automatically approved after the required number of semester hours of research work have been completed. The thesis or problem report must conform with the general requirements of the Graduate School and with any additional requirements established by the Department of Civil Engineering.

Final Examination. A candidate shall be required to pass an examination which may be written, oral, or both, to be administered by the student's advisory and examining committee. The examination shall cover course material and the thesis or problem report, depending upon the program followed.

Approval for the M.S.C.E. degree is restricted to those holding a baccalaureate degree in civil engineering.

Master of Science in Engineering (M.S.E.)

The Master of Science in Engineering (M.S.E.) program is available to students approved for the graduate program who possess a baccalaureate degree in a technical area other than civil engineering. Students entering this graduate program must complete appropriate undergraduate work as specified by departmental regulations.

Doctor of Philosophy (Ph.D.)

The Doctor of Philosophy (Ph.D.) degree is administered through the College of Engineering Interdisciplinary Program. A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations outlined in general requirements for graduate work in "A Guide to the Graduate Program in Engineering." The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of civil engineering.

Civil Engineering (C.E.)

- 201. *Principles of Boundary Surveying.* 3 hr. PR: C.E. 101 or consent. A study of the retracement requirements for metes and bounds survey systems. The study will include interpretation and writing of the property descriptions, legal principles related to boundary establishment, and analytical approaches to boundary location. 3 hr. rec.
- 212. *Concrete and Aggregates.* 3 hr. PR: C.E. 110 or consent. Considerations and methods for the design of concrete mixes. Properties of portland cement and aggregates and their influence on the design and performance of concrete mixtures. Testing of concrete and aggregate and the significance of these tests. 2 hr. rec., 3 hr. lab.
- 213. *Construction Methods.* 3 hr. PR: C.E. junior or senior standing. Study of construction methods, equipment, and administration with particular emphasis on the influence of new developments in technology. 3 hr. rec.
- 222. *Open Channel Flow.* 3 hr. PR: C.E. 120. Hydraulic problems associated with natural waterways, man-made waterways, and design of hydraulic structures of open channels. 3 hr. rec.

231. *Highway Engineering*. 3 hr. PR: C.E. 132, 180. Highway administration, economics and finance; planning and design; subgrade soils and drainage; construction and maintenance. Design of a highway. Center line and grade line projections, earthwork and cost estimate. 2 hr. rec., 3 hr. lab.
233. *Urban Transportation Planning and Design*. 3 hr. PR: C.E. 132 or consent. Introduction to principles of planning and physical design of transportation systems for different parts of the urban area. Land use, social, economic, and environmental compatibilities are emphasized. Evaluation and impact assessment.
235. *Railway Engineering*. 3 hr. PR: C.E. 101. Development and importance of the railroad industry. Location, construction, operation, and maintenance. 3 hr. rec.
240. *Applied Hydrology*. PR: Consent. The hydrologic cycle with emphasis on precipitation and runoff as related to design of hydraulic structures, soil and water conservation, and flood control. 3 hr. rec.
245. *Properties of Air Pollutants*. 3 hr. PR: Consent. Physical, chemical, and biological behavioral properties of dusts, droplets, and gases in the atmosphere. Air pollutant sampling and analysis. Planning and operating air pollution surveys. 2 hr. rec., 3 hr. lab.
251. *Public Health Engineering*. 3 hr. PR: C.E. 146 or 147 or consent. Engineering aspects involved in control of the environment for protection of health and promotion of comfort of man. Communicable disease control, milk and food sanitation, air pollution, refuse disposal, industrial hygiene, and radiological health hazards. 3 hr. rec.
252. *Water Resources Engineering*. 3 hr. PR: C.E. 120. Application of hydrologic and hydraulic principles in the design and analysis of water resources systems. Topics include hydraulic structures, economics and water law irrigation, hydroelectric power, navigation, flood-drainage mitigation and water-resources planning. 3 hr. rec.
260. *Structural Analysis II*. 3 hr. PR: C.E. 160. Fundamental theory of statically indeterminate structures. Analysis of indeterminate beams, frames and trusses by stiffness and flexibility methods; computer aided structural analysis by standard computer codes; study of influence lines for beams, frames and trusses. 3 hr. rec.
270. *Reinforced Concrete Design*. 3 hr. PR: C.E. 110, 160. Behavior and design of reinforced concrete members. Material properties; design methods and safety considerations; flexure; shear; bond and anchorage; combined flexure and axial load; footings; introduction to torsion, slender columns, slabs, and prestressed concrete. 2 hr. rec., 3 hr. lab.
271. *Steel Design*. 3 hr. PR: C.E. 260. Design of steel bridge and building systems with emphasis on connections, beams, columns, plastic design, and cost estimates. 2 hr. rec., 3 hr. lab.
274. *Timber Design*. 3 hr. PR: C.E. 260. Fundamentals of modern timber design and analysis. Topics include wood properties, design of beams, columns, trusses and pole structures using dimension lumber, glue-laminated products, and plywood. 2 hr. rec., 3 hr. lab.
281. *Foundations Engineering*. 3 hr. PR: C.E. 180. Soils exploration and the design and analysis of engineering foundations. Emphasis on earth pressures and design of retaining walls, studies of bracing systems, and the elements of shallow and deep foundations for bridges and buildings. 3 hr. rec.
290. *Civil Engineering Problems*. 1-6 hr. PR: Junior or senior standing. Special topics in various aspects of civil engineering analysis, design and construction.
291. *Comprehensive Project I*. 2 hr. PR: Senior standing or consent. Application of civil engineering principles, through group studies, to develop a solution for a com-

- prehensive engineering problem. Consideration given to a problem involving all aspects of civil engineering. 1 hr. rec., 3 hr. lab.
292. *Comprehensive Project II*. 2 hr. PR: C.E. 291 (taken in preceding semester); Engl. 208. Continuation of C.E. 291. 1 hr. rec., 3 hr. lab.
 296. *Civil Engineering Studies*. 1-3 hr. (Only 3 hr. credit may be applied toward the B.S.C.E. degree). PR: Consent. Supervised internships and field experience in civil engineering analysis, design, and construction.
 307. *Photogrammetry*. 3 hr. PR: C.E. 101. Geometry and interpretation of aerial photography; flight planning; radial-line control; principles of stereoscopy; plotting instruments. 2 hr. rec., 3 hr. lab.
 308. *Geodesy*. 3 hr. PR: C.E. 101. Precise base line measurements, triangulation and leveling, geodetic astronomy; figure of the earth, map projections; rectangular coordinate systems; least squares adjustment; gravity. 3 hr. rec.
 310. *Bituminous Materials and Mixtures*. 3 hr. PR: C.E. 110 or consent. Manufacture, testing, and nature of bituminous mixtures including the influence of aggregates, temperature, and other variables on mix design. Significance of test methods and specifications. Construction practice. 2 hr. rec., 3 hr. lab.
 311. *Pavement Design*. 3 hr. PR: C.E. 110, 180. Effects of traffic, soil, environment, and loads on the design and behavior of pavement systems. Design of pavement systems. Consideration of drainage and climate. Pavement performance and performance surveys. 3 hr. rec.
 332. *Airport Planning and Design*. 3 hr. PR: C.E. 132 or consent. Financing, air travel demand modeling, aircraft trends, traffic control, site selection, ground access, noise control, geometric design, pavement design, terminal facilities. 3 hr. rec.
 333. *Geometric Design of Highways*. 3 hr. PR: Consent. The theory and practice of geometric design of modern highways. Horizontal and vertical alignment, cross-slope, design speed, sight distances, interchanges, and intersections. Critical analysis of design specifications. 2 hr. rec., 3 hr. lab.
 334. *Introduction to Traffic Engineering*. 3 hr. PR: C.E. 132 or consent. The purpose, scope, and methods of traffic engineering. Emphasis on the three basic elements of each element and interactions between the elements. Laboratory devoted to conducting simple traffic studies, solving practical problems, and designing traffic facilities. 2 hr. rec., 3 hr. lab.
 349. *Solid Waste Disposal*. 3 hr. PR: Consent. Patterns and problems of solid waste storage, transport, and disposal. Examinations of various engineering alternatives with appropriate consideration for air and water pollution control and land reclamation. Analytical approaches to recovery and reuse of materials. 2 hr. rec., 3 hr. lab.
 350. *Sanitary Chemistry and Biology*. 3 hr. PR: C.E. 147 or consent. Study of physical and chemical properties of water. Theory and methods of chemical analysis of water, sewage, and industrial wastes. Biological aspects of stream pollution problems. 2 hr. rec., 3 hr. lab.
 356. *Principles of Biological Waste Treatment*. 3 hr. PR: C.E. 350 or consent. Examination of biological treatment systems related to microbiology and function. Models used to describe system behavior and kinetics are developed. Laboratory and field experiments are performed to understand the relation between operation and design. 2 hr. rec., 3 hr. lab.
 359. *Basic Radiological Health*. 3 hr. PR: Consent. Fundamental theory and terminology. Environmental and occupational hazards in the nuclear field. Radioactive waste disposal. Laboratory measurements of radioactivity. 3 hr. rec.

361. *Statically Indeterminate Structures*. 3 hr. PR: C.E. 260 or consent. Force and displacement methods of analysis; energy principles and their application to trusses, frames and grids; effects of axial forces; influence lines for frames, arches and trusses; secondary stress analysis. 3 hr. rec.
363. *Introduction to Structural Dynamics*. 3 hr. PR: C.E. 361 or 460. General theory for dynamic response of systems having one or several degrees of freedom. Emphasis on the application of dynamic response theory to structural design. 3 hr. rec.
372. *Plastic Design of Steel Structures*. 3 hr. PR: C.E. 260, 271 or consent. Fundamental concepts of inelastic behavior in steel. Analysis of structures for ultimate load. Influence of axial forces, shear forces, and local buckling on the plastic moment. Study of structural connections and deflections. Steel structures design. 3 hr. rec.
373. *Prestressed Concrete*. 3 hr. PR: C.E. 260, C.E. 270, or consent. Behavior and design of prestressed concrete members. Materials, bending, shear, torsion, methods of prestressing, prestress losses, deflections, compression members, composite members, indeterminate structures, 3 hr. rec.
380. *Soil Properties and Behavior*. 3 hr. PR: C.E. 180 or consent. Soil mineralogy and the physico-chemical properties of soils and their application to an understanding of permeability, consolidation, shear strength, and compaction. Prediction of engineering behavior of soils in light of physico-chemical concepts. 3 hr. rec.
381. *Soil Testing*. 3 hr. PR: C.E. 180 or consent. Experimental evaluation of soil properties and behavior. Emphasis is placed on the proper interpretation of experimental results and application of such results to practical problems. 1 hr. rec., 6 hr. lab.
385. *Airphoto Interpretation*. 3 hr. Study of techniques for obtaining qualitative information concerning type and engineering characteristics of surficial materials. Use of airphoto interpretation for evaluation of engineering problems encountered in design and location of engineering facilities. 3 hr. rec.
421. *Hydraulic Structures*. 3 hr. PR: C.E. 120 or consent. Hydraulic analysis and design of engineering structures such as reservoirs, dams, spillways, gates, and outlet works. Study of hydraulic machinery, irrigation, hydroelectric power, drainage, and flood control. 3 hr. rec.
422. *Surface and Subsurface Drainage*. 3 hr. PR: Consent. Nature and requirements of drainage studies and drainage design as they pertain to transportation facilities. Emphasis on the theory of drainage design and a critical analysis of drainage practice. 3 hr. rec.
430. *Highway Laws*. 3 hr. PR: Consent. Highway laws with emphasis on aspects particularly related to planning functions, such as reservation of right-of-way, access control, eminent domain, systems classification, and the basis for the existence and operation of various planning agencies. 3 hr. rec.
431. *Traffic Flow Theory*. 3 hr. PR: I.E. 213 and C.E. 438 or consent. Basic concepts of quantitative analysis of traffic systems. Probability theory, queuing theory, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic on two-lane roads, simulation of traffic problems. 3 hr. rec. (Also listed as I.E. 431.)
432. *Highway Economics and Administration*. 3 hr. PR: Consent. Methods of financing highways, including federal participation. Establishing allocation of highway cost and determination of economic justification of routes. Analysis of highway administrative organization. 3 hr. rec.
434. *Urban Problems*. 3 hr. PR: Consent. Problems of transportation in the urban area as they relate to general development of the city. Emphasis on the engineer in planning for urban transportation and relationship of engineer to the city planner and city administration. 3 hr. rec.

436. *Highway Planning I.* 3 hr. PR: Consent. Planning programs and methods including highway needs studies, priority rating systems, and programming methods. Consideration of traffic assignment and forecasting techniques. Devoted primarily to rural route problems. Case history method of study utilized. 3 hr. rec.
437. *Highway Planning II.* 3 hr. PR: C.E. 436. Continuation of C.E. 436 with special attention to urban locations and planning. 3 hr. rec.
438. *Traffic Engineering Characteristics.* 3 hr. PR: C.E. 231 or consent. Analysis of basic characteristics of drivers, vehicles, and roadways that affect the performance of road systems. Studies of volumes, speeds, delays, intersections, interchanges, capacity, and accidents will be considered. 2 hr. rec., 3 hr. lab.
439. *Traffic Engineering Operations.* 3 hr. PR: C.E. 438. Theory and practice of application of traffic engineering regulations, traffic flow theory, design and use of traffic control devices and signal systems. Traffic administration and parking control. 3 hr. rec.
446. *Air Pollution Control Engineering.* 3 hr. PR: C.E. 245 or consent. Engineering alternatives for achieving various degrees of air pollution control. Factors considered in selection and specification of dust and gas collectors and converters, and use of alternate process methods and process materials. 2 hr. rec., 3 hr. lab.
447. *Air Pollution Control Standards.* 3 hr. PR: C.E. 446 or consent. Technical, economical, and social factors used in developing and establishing air pollution standards, criteria, and control limitations. Relationships between process design specifications, pollutant emission limitations, ambient air pollution effects, air quality standards, and emission performance limitations. 2 hr. rec., 3 hr. lab.
448. *Air Pollution Control Programs.* 3 hr. PR: C.E. 446 or consent. Examination of air pollution control programs. Rationales and patterns of organization structure and operating administrative factors. Relationship with land use planning, solid waste, fire prevention, water pollution control, building inspection, and economic development agencies. 3 hr. rec.
452. *Water Treatment Theory.* 3 hr. PR: C.E. 350. Theory of various procedures and techniques utilized in treatment of water for municipal and industrial use. Review of water quality criteria. Design of water purification facilities. 2 hr. rec., 3 hr. lab.
454. *Industrial and Advanced Waste Treatment.* 3 hr. PR or Conc.: C.E. 350 or consent. Basic physical and chemical unit operations used in industrial and advanced waste treatment; applications for waste water reclamation and reuse; study of industrial wastes from standpoint of process, source, and treatment. 3 hr. rec.
455. *Municipal and Industrial Design of Solid Wastes Disposal Operations.* 3 hr. PR: C.E. 349 or consent. Design methods and equipment for disposal of solid wastes; on site preparation; volume and density modification; and reclamation of marketable materials. Process, source, treatment, and final disposal with considerations of waste reclamation and reuse of energy. 3 hr. rec.
457. *Hydraulics of Sanitary Engineering Works.* 3 hr. PR: C.E. 120. Hydraulics of sanitary sewers, storm sewers and water distribution systems; design of special structures including pumping stations, siphons and retention basins; analysis of flow sources including sewer infiltration studies, material selection and construction methods. 3 hr. rec.
458. *Design of Sanitary Works.* 3 hr. PR: C.E. 120. Water supply and waste water disposal problems. Design of treatment facilities. 2 hr. rec., 3 hr. lab.
460. *Introduction to Finite Element Analysis.* 3 hr. PR: C.E. 361 or consent. Relationships of elasticity theory; definitions and basic element operations; direct and variational methods of triangular and rectangular elements related to plane stress, plane strain and flat plates in bending; variational principles in global analysis. 3 hr. rec.

461. *Bridge Engineering*. 3 hr. PR: C.E. 361 or consent. Statically indeterminate trusses, continuous trusses; steel and concrete arches; long-span and suspension bridges; secondary stresses. 3 hr. rec.
462. *Numerical Methods of Structural Analysis*. 3 hr. PR: C.E. 361 or 460. Methods of successive approximations and numerical procedures for solution of structural problems. Application of these procedures to analysis of bridges and buildings. 3 hr. rec.
470. *Behavior of Steel Members*. 3 hr. PR: C.E. 271 or consent. Elastic behavior of steel members subjected to axial load, bending, and torsion. Elastic and inelastic response of beams, columns, and beam-columns to load and the resulting design implications. Comparison with standard steel codes and specifications. 3 hr. rec.
471. *Light Gage Metal Design*. 3 hr. PR: C.E. 260, 271, or consent. Analysis and design of light gage material systems; flexural and compression members design; investigations into post buckling strength and optimum weight systems. 3 hr. rec.
473. *Structural Design for Dynamic Loads*. 3 hr. PR: C.E. 363 or consent. Nature of dynamic loading caused by earthquakes and nuclear weapons blasts; nature of dynamic resistance of structural elements and structural systems; criteria for design of blast-resistant and earthquake resistant structures; simplified and approximate design methods. 3 hr. rec.
474. *Behavior and Advanced Design of Timber Structures*. 3 hr. PR: C.E. 260, 374, Wd. Sc. 261 or consent. Behavior and analysis of structural systems and components; behavior of members subjected to bending, shear, and compression, impact, and vibration; time dependent characteristics of timber members under load. 3 hr. rec.
475. *Analysis and Design of Multistory Structures*. 3 hr. (May be repeated once.) PR: C.E. 363, and C.E. 270 or 271. Introduction; service, structural and construction systems; analysis and design for lateral and gravity forces; structural modeling; computer applications; approximate methods; connections; foundations; review of standard building codes; special topics. 3 hr. rec.
476. *Behavior of Reinforced Concrete Members*. 3 hr. PR: C.E. 270 or consent. Studies of actual member behavior; members in flexure, combined flexure, shear, and torsion; bond and anchorage; combined axial load and flexure; slender columns; deep beams; derivation of current code provisions. 3 hr. rec.
477. *Behavior of Reinforced Concrete Structures*. 3 hr. PR: C.E. 476. Continuation of C.E. 476. Limit state design; continuous beams and frames; moment redistribution; flat plates and flat slabs; two-way slabs; yield line theory; comparison of theory with standard practice; results of recent research; special topics. 3 hr. rec.
478. *Thin Shell Roof Structures I*. 3 hr. PR: Math. 113, C.E. 361 or consent. Development and solution of the fundamental elastic equations for barrel vault roofs using matrix algebra. Effects of edge members upon the strength and stiffness of barrel vault roofs. Design of simple shell structures. 3 hr. rec.
479. *Thin Shell Roof Structures II*. 3 hr. PR: C.E. 478 or consent. Continuation of C.E. 478. Analysis of multiple cylindrical shells using the theory of elasticity and matrix algebra. Ultimate load and variational methods in shell analysis. Design and analysis of doubly curved shells. 3 hr. rec.
480. *Geotechnic*. 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. Presented cooperatively with the Department of Agronomy and the Department of Geology. 3 hr. rec.
482. *Foundation Engineering*. 3 hr. PR: C.E. 281, 380, or consent. Study of soil-structure interaction. Application of principles of geotechnical engineering and structural

analysis and design to the design of spread footings, pile foundations, retaining walls, and bracing systems for deep excavations. 3 hr. rec.

- 483. *Earthwork Design*. 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of embankments of earth and rock. Detailed attention is given to compaction methods and equipment, stability of natural and manmade slopes, embankment foundation stability. 3 hr. rec.
- 484. *Groundwater and Seepage*. 3 hr. PR: Consent. Flow of groundwater through soils and its application to the design of highways and dams and to construction operations. Emphasis is placed on both the analytical and classical flow net techniques for solving seepage problems. 3 hr. rec.
- 486. *Soil Dynamics*. 3 hr. PR: C.E. 380 and consent. Consideration of the simple damped oscillator, wave propagation in elastic media, dynamic field and laboratory tests, dynamic soil properties, and foundation vibrations. Introduction to geotechnical aspects of earthquake engineering. 3 hr. rec.
- 490. *Teaching Practicum*. 1-3 hr. PR: Consent. Supervised practices in college teaching of civil engineering.
- 491. *Advanced Study*. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
- 495. *Seminar*. 1-2 hr. PR: Consent. Studies and group discussion of structural, fluid mechanics, surveying, transportation, soil mechanics and foundations, and sanitary problems.
- 496. *Graduate Seminar*. 1 hr. PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of the student's program.
- 497. *Research*. 1-15 hr.
- 498. *Thesis*. 2-4 hr. PR: Consent.
- 499. *Graduate Colloquium*. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in its academic and cultural program.

(See Eng. 260 under General Engineering in Part 5.)

COMMUNITY HEALTH EDUCATION

Bill R. Carlton, Chairperson of the Department of Health Education
1156 Agricultural Sciences Building

Degrees Offered: M.S., Ed.D.

Graduate Faculty: Members Carlton and Simon. Associate Member Pearson.

The Master of Science in Community Health Education (M.S.) and the Doctor of Education (Ed.D.), with an emphasis in Community Health or School Health, are available. These programs involve a core of courses in health education combined with a cognate area designed to satisfy individual needs and professional objectives. All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Health Education.

Community Health Education (M.S.)

To be selected into the M.S. program in Community Health Education, an applicant must have sufficient background in the area of specialization to

qualify for admission to graduate courses in community health education. Students with inadequate backgrounds may be required to take additional course work which may not apply to the program.

Health Education (HI. Ed.)

301. *Advanced School Health*. I, S. 3 hr. PR: Graduate standing and consent. Analysis of problems in school health services, healthful school living, nature of health education, and scope of health instruction which confronts teachers and administrators.
305. *Philosophy of Health Education*. I, S. 3 hr. PR: Graduate standing and consent. Analysis of the scientific bases, purposes, procedures, and content, with implications for school and public health education.
306. *Community Health*. II, S. 3 hr. PR: Graduate standing and consent. Health problems requiring community action, basic public health activities, community organization for health protection, voluntary health agencies, school health programs, and the role of state and federal agencies in the community health program.
307. *Community Health: Human Sexuality*. I, II, S. 3 hr. PR: Consent. Analysis of sex-related issues including parenting, sex education, sexual sanctions, pornography, sexual dysfunction, and sexual variance. Designed for teachers, health professionals, and interested laymen.
308. *Community Health: Death Education*. I, II, S. 3 hr. PR: Consent. Surveys death/dying from humanistic viewpoint. Examines philosophical, psychological, legal, and sociological aspects of death, grief, and mourning. Appropriate for teachers, health professionals, and others desiring understanding of death as a part of living.
309. *Community Health: Drug Education*. I, II, S. 3 hr. PR: Consent. Designed to help students learn appropriate components of a drug education program, gain an understanding of drug taking in this society, and acquire insights into dependent behaviors.
320. *Roles and Functions of Health Educators*. I. 3 hr. PR: Graduate standing and consent. An investigation of the roles and functions of the health educator in a variety of community settings including hospitals, clinics, voluntary agencies, etc.
330. *Health Education and Behavioral Science*. I, S. 3 hr. PR: Consent. Integrates the concepts of health education and behavioral science to facilitate changes in health behavior of individuals and groups.
373. *Professional Development*. I, II, S. 1-6 hr. (May be repeated for credit.) PR: Department consent. Specially designed experiences for those interested in advancing professional skills in a particular specialty. Not for degree credit in programs in the College of Human Resources and Education.
376. *Evaluation of Health Education Research*. I, S. 3 hr. PR: Ed. P. 311 or consent. Study of published research to determine basic scientific accuracy and value.
385. *Practicum (Field)*. I, II, S. 1-15 hr. PR: Graduate standing and consent. Under the guidance of faculty and counselors, students may assume major responsibility during a semester in a community-wide program. (Required of all students in the M.S. program.)
401. *Health Care Organization and Management*. II. 3 hr. PR: Consent. To provide future managers, present practitioners, and interested students with organizational and managerial concepts and theories to help analyze and resolve administrative problems in planning and delivering health services in the community.
490. *Teaching Practicum*. I, II. 1-3 hr. PR: Graduate standing and consent. Supervised practices in college teaching of health-related learning experiences.

- 491. *Advanced Study*. I, II, S. 1-6 hr. PR: Graduate standing and consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
- 496. *Graduate Seminar*. I, II. 1 hr. PR: Graduate standing and consent. Graduate students will present at least one seminar to the assembled faculty and graduate student body of this program.
- 497. *Research*. I, II, S. 1-15 hr. PR: Graduate standing and consent.
- 498. *Thesis*. I, II, S. 2-4 hr. PR: Graduate standing and consent.
- 499. *Graduate Colloquium*. I, II, S. 2-4 hr. PR: Graduate standing and consent.

COMPUTER SCIENCE

Donald F. Butcher, *Chairperson of the Department of Statistics and Computer Science*
424 Hodges Hall

Degree Offered: M.S.

Graduate Faculty: Members Dodrill, Henry, Lane, Muth, and Trapp. Associate Member Reddy.

The Department of Statistics and Computer Science offers a Master of Science (M.S.) degree with a major in Computer Science. The master of science degree is intended to qualify the student to: assume a professional role in an education, industrial, or governmental research project; teach in a junior or senior college; or undertake advanced training toward a doctorate in computer science.

Because many students receive baccalaureate degrees from colleges which do not offer undergraduate programs in computer science a student with an outstanding undergraduate record does not need a degree in computer science to enter the M.S. degree program in computer science. A good background in engineering, mathematics, or science is reasonable preparation for graduate work in computer science.

Two options are available for students seeking a Master of Science in Computer Science. The two options are:

1. *Problem Report Option:* 36 hours of course work including 3 hours of credit for a problem report.
2. *Thesis Option:* 30 hours of course work including 6 hours of credit for a thesis. Students must have a B.S. degree in Computer Science or equivalent to enter this option.

Students are expected to know the material contained in the following courses upon admission to the program. Otherwise, these deficiencies must be removed as early as possible in the student's degree program.

1. One year of Calculus (Math. 15, 16 or equiv.).
2. One year of a High-Level Programming Language (PL/1 preferred, Com. S. 1, 2 or equiv.).
3. One year of Principles of Computer Science (Com. S. 50, 51, or equiv.).
4. Multivariable Calculus or Discrete and Numerical Methods (Math. 17 or Com. S. 120.)

Students with deficiencies are encouraged to start their graduate work during summer school because they can complete either sequence Com. S. 1-2 or Com. S. 50-51 during the summer.

Minimum required courses for either option are:

- (a) Three courses from Com. S. 310, 330, 340, 360, 370.

(b) Two additional 300-level computer science courses.

(c) Two additional 200- or 300-level courses in Statistics, Computer Science, Mathematics, Industrial Engineering, or Electrical Engineering.

All students must pass a final oral examination over the problem report or thesis and course work. Foundation material for the oral examination is contained in Com. S. 310, 330, 340, and 360.

More information concerning graduate studies may be found in "Graduate Programs in Statistics and Computer Science" available from the department. (For statistics courses of instruction, see "Statistics.")

Computer Science (Com. S.)

- 220. *Numerical Analysis 1. I.* 3 hr. PR: Math. 16 and Com. S. 120 or consent. Solutions of equations, interpolation and approximations. Numerical differentiation and integration. Numerical solution of initial value problems in ordinary differential equations. (Equiv. to Math. 321.)
- 221. *Numerical Analysis 2. II.* 3 hr. PR: Math 241 and Com. S. 220 or consent. Solutions of linear systems by direct and iterative methods. Matrix inversion, evaluation of determinants, and calculation of eigenvalues and eigenvectors of matrices. Application to boundary value problems in ordinary differential equations. (Equiv. to Math. 322.)
- 223. *Applied Matrix Algebra. I.* 3 hr. PR: Math. 18 or 51. Elementary matrix concepts and operations, vector spaces, characteristic roots and vectors, generalized inverses, systems of linear equations, patterned matrices, orthogonal and other special matrices. (Equiv. to Stat. 223.) (Course will not be offered in 1981-82.)
- 230. *Programming Languages. I.* 3 hr. PR: Com. S. 51. Formal definition of programming languages including specification of syntax and semantics. Structure of simple statements and algorithmic languages; list processing and string manipulation languages.
- 240. *Systems Programming. I, II.* 4 hr. PR: Com. S. 51. Software organization for the support of computer components. Addressing techniques process and data modules, file system organization and management. Traffic control and communication with peripheral devices.
- 241. *Systems Programming. II.* 3 hr. PR: Com. S. 240. Memory management; name management; file systems; segmentation; protection; resource allocation; pragmatic aspects in the design and analysis of operating systems.
- 248. *Programming Small Computers. II.* 3 hr. PR: Com. S. 51. Processing of data using small laboratory digital computers.
- 260. *Information Analysis. II.* 3 hr. PR: Com. S. 51. Information analysis and logical design of a computer system. Exercises and case studies are used to give students proficiency in information analysis techniques. Projects are assigned to provide practical experience in systems development and implementation.
- 270. *System Design. I.* 3 hr. PR: Com. S. 51. Underlying principles of system design and techniques. A theme to be carried throughout the course is the iterative nature of the analysis and design process. Implementation and conversion problems also are considered. Practical projects are assigned to give students experience in actual situations.
- 291. *Special Topics. I, II, S.* 1-6 hr. PR: Consent. Advanced study of special topics in computer science.
- 301. *Computers in Research 1. I.* 3 hr. Use of computers in research. Organization and characteristics of computers. Algorithms, machine language programming, scientific oriented language programming subprograms, program segmentation and

linkage (Statistics and Computer Science majors should obtain approval of their graduate committee before taking this course for credit.)

- 301A. *Computer Applications*. 1 hr. A discussion of networks, hardware, software, computer applications, and social considerations. (Course will not be offered in 1981-82.)
- 301B. *FORTRAN IV Programming*. 1 hr. (Course will not be offered in 1981-82.)
- 301C. *Job Control Language*. 1 hr. PR: Com. S. 301B or consent. Job control language required to effectively utilize WVU's computing system. (Course will not be offered in 1981-82.)
310. *Application Programming 1. I*. 3 hr. PR: Programming knowledge. Survey of computer application areas by industry, and summary of basic techniques used in computer applications problems, illustrated with real world examples. Options and decisions involved in problem solving emphasized.
311. *Application Programming 2. II*. 3 hr. PR: Com. S. 310 or consent. Continuation of Com. S. 310 where students work on a particular project under supervision of a faculty member and present a written and oral report on their project.
320. *Numerical Solution of Linear Equations*. 3 hr. PR: Com. S. 120 or consent. Numerical solution of large systems of linear equations using direct and iterative methods. Calculation of inverses and generalized inverses of matrices. Numerical methods for the determination of eigenvalues and eigenvectors.
330. *Design of Language Processors. II*. 3 hr. PR: Com. S. 230. Study of the design and construction of automatic programming language processors. Investigation of the structure of scientific and business oriented compilers, list processors, and information processing languages.
340. *Theory of Operating Systems. I*. 3 hr. PR: Com. S. 241. Theoretical aspects of multiprogrammed and virtual operating systems. Topics include: concurrent processes, processor management, storage management, scheduling algorithms, and resource protection.
341. *Computer Systems. II*. 3 hr. PR: Com. S. 340 and Stat. 312, or consent. Simulation, evaluation, and measurement of computer systems. Techniques of measurement and evaluation using hardware and software monitors, methods of model validation, and creation of management reports.
350. *Software Engineering in Data Communications. II*. 3 hr. PR: Com. S. 240 or consent. Data communication principles, software design techniques for implementing data communications systems, testing and debugging techniques, networks and data link control, software design in a network environment. A "hands-on" project in data communications design is included.
360. *Design of Database Systems. I*. 3 hr. PR: Com. S. 260. Design evaluation, implementation and use interface of database systems. Topics include: storage structures, data languages, security and relational, hierarchial and network implementation approaches.
370. *System Implementation. II*. 3 hr. PR: Com. S. 260 and 270. Underlying principles of system implementation are covered both from a theoretical and from a practical point of view. As part of the course, each student will participate with other students in the implementation of a production system.
380. *Interactive Computer Graphics. II*. 3 hr. PR: Com. S. 230 or 240 or 260 or consent. Data structures and list handling, picture structures and transformation, rendering of surfaces and solids, interaction handling, display processors and programming systems and graphics system organization.
490. *Teaching Practicum. I and II*. 1-3 hr. PR: Consent. Supervised practices in college teaching of computer science.

491. *Advanced Studies in Computer Science*. I, II, S. 3-6 hr. PR: Consent. Investigation in advanced computer science subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Research in Computer Science*. I, II, S. 1-15 hr. PR: Consent.

COUNSELING AND GUIDANCE

Jeffrey K. Messing, *Chairperson of the Department*
502 Allen Hall

Degree Offered: M.A., Ed.D.

Graduate Faculty: Members Blaskovics, L. S. Cormier, W. H. Cormier, DeLo, Jacobs, Majumder, Marinelli, Masson, Messing, Srebalus, Tunick, and Yura. Associate Members Greever and Moriarty.

The Department of Counseling and Guidance and Rehabilitation Counseling of the College of Human Resource and Education offers a curriculum at the master's degree level. All students enroll for a general counseling core during their first semester and then select an area of emphasis for the balance of their graduate studies. All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Counseling and Guidance.

Students are encouraged to pursue as much of their program as possible on a full-time basis. Applications from part-time students will also be accepted.

Core Requirements for Counseling and Guidance

All students will be expected to take the following core courses:

C&G 301 — Fundamentals of Counseling

C&G 303 — Basic Course in Guidance

C&G 305 — Theory and Practice of Human Appraisal

C&G 306 — Counseling Theory and Techniques

Counseling and Guidance (M.A.)

Counseling provides a broad opportunity to work with children at the elementary-school level, adolescents at the secondary-school level, young adults at the college level, and in community agencies. The school counselor is involved in personal counseling, career guidance, vocational and educational counseling, family counseling, and consultation on classroom problems with teachers and administrators. Counselors must be equipped to work with both individuals and groups. Much of the school counselor's work is carried out in classrooms with teachers and students. The school counselor also is active in working with community agencies. At the college level, the counselor may work extensively with the special educational services available for the benefit of the college student. Degree requirements include completion of the core curriculum, required counseling and guidance course work, and 4 semester hours of practicum under faculty direction. The program required a minimum of 36 hours with a 3.0 grade-point average. In addition to completing all course work and the practicum satisfactorily, the candidate must demonstrate the ability to assume the responsibility required of a professional counselor and the personal characteristics essential to effective working relationships with others.

Please contact the department for a listing of the additional required courses in this area.

(An active summer program is available for part-time students. Degree requirements may be completed in three consecutive summers.)

Professional Counselor Endorsement For School Counselors in West Virginia (Certification)

1. A minimum grade-point average of 3.0.
2. Recommendation of the faculty.
3. A valid professional teaching certificate at the level for which counseling and guidance endorsement is desired.
4. Two years of successful education experience in teaching or counseling and guidance or a combination thereof at a level for which endorsement is desired. (A new experimental alternate pattern was approved for 1980, and later, which substitutes a special training pattern for the teaching certificate and teaching experience. A department representative should be contacted for more information.)
5. Completion of the required pattern of certification courses.
6. A one-year supervision experience during the first year of employment as a West Virginia school counselor.

Community Counseling — In reviewing the curriculum available in Counseling and Guidance, the applicant will note that much of the course work provides the background applicable for employment in general community agency work. Some of our graduates who do not take employment directly in rehabilitation or school settings find a limited number of opportunities as general counselors in the fields of public welfare, mental health, drug and alcohol counseling, employment security, and corrections.

Counseling and Guidance (C.A.S.)

Additional Admission Requirements

All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Counseling and Guidance.

1. Completion of a master's degree in Counseling and Guidance or equivalent comparable to WVU master's degree in Counseling and Guidance with approved practicum experience.
2. Minimum graduate grade-point average of 3.0.
3. A total score of 1,000 on the Graduate Record Examination aptitude test is recommended.
4. Personal interview with faculty members in Counseling and Guidance.
5. Demonstration of competency in counseling, measurement, statistics, and the guidance function in education as evidenced by reference and appropriate examinations.
6. Evidence of successful appropriate work experience.
7. Written justification for choice in area of specialization.
8. Three references for recommendation.
9. Plan of study approved by adviser.

Areas of Specialization

Elementary School Counseling
Student Personnel Work
Employment Counseling

Pupil Personnel Services
Secondary School Counseling

Requirements for Graduation

1. Completion of 36 semester hours of approved graduate work.
2. A minimum grade-point average of 3.2 on all course work attempted under the Certificate of Advanced Study Program.
3. Demonstration of competencies as a specialist in chosen area of specialization.
4. Recommendation of the department.

Program

1. 12 semester hours core from Counseling and Guidance:
C&G 385 — Practicum, 3 hr.
C&G 331 — Consultation Techniques, 3 hr.
C&G 401 — Advanced Counseling Techniques, 3 hr.
C&G 469 — Theory and Practice of Student Appraisal, 3 hr.
2. 12 semester hours elected with adviser's consent in specialty area of advanced courses external to the Counseling and Guidance program area.
3. 6 hours to achieve competence in consumption and production of field research.
4. 6 hours research problem in area of specialization.

Residency (Minimum)

1. One semester or two summers (12 hr.) on campus.
2. Program completion of 12 hr. off-campus and transfer, or approved interuniversity cooperative program.

Counseling and Guidance (Ed.D.)

Doctoral study in Counseling and Guidance includes courses in the following areas: measurement and evaluation, consultation and teaching, and counseling practice. All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Counseling and Guidance. The program typically includes course work hours in excess of the minimum limits established in the College of Human Resources and Education requirements for the Ed.D. degree.

Additional Entrance Requirements

1. Completion of a master's degree program in Counseling and Guidance or equivalent. The equivalency should be comparable to the WVU master's degree program.
2. It is recommended that the student's graduate grade-point average be in the vicinity of 3.5.
3. A personal interview with the faculty is necessary. If this is not possible, the department reserves the right to have the applicant be interviewed by a professor in another institution who can make recommendations regarding the student's qualifications for doctoral study.
4. At least three references should be submitted to the department and should pertain to the individual's competency in counseling, measurement, statistics, research, etc. The references also should contain information regarding the individual's personal characteristics particularly as they relate to the completion of a doctoral program.

5. Announcements regarding admission are made on or before March 15. Materials received after January 15 will not be reviewed until the following year. All students not enrolling for courses during the year following admission must reapply before taking course work.

Counseling and Guidance (C&G)

216. *Behavior Problems and the School*. I, II, S. 2 hr. A course primarily oriented toward assisting educators utilize current psychological principle related to classroom discipline, as well as academic and social adjustment.
283. *Workshop in Counseling and Guidance*. I, II, S. 1-12 hr. PR: Consent. To take care of credits for special workshops and short intensive limit courses on methods, supervision, and other special topics.
301. *Fundamentals of Counseling*. I, II, S. 3 hr. PR: Consent. Development and application of basic counseling skills including interviewing, clinical observation, and a general orientation to counseling settings. Evaluation will be based on strengths and deficits in intra and interpersonal skills and on demonstration of counseling skills in checkout situations. In setting laboratory experience required.
302. *Human Relationships*. I, II, S. 1-3 hr. PR: Consent. Experientially based learning model which focuses on group processes and procedures. Provides self-screening opportunities for prospective counselors. Evaluation is based on personal characteristics essential to effective working relations with others.
303. *Basic Course in Guidance*. I, II, S. 2-3 hr. An overview of the counseling profession, treating current practices and issues.
305. *Theory and Practice of Human Appraisal*. I, II, S. 3 hr. An overview of standardized evaluation methods commonly utilized in educational and rehabilitation settings. Experience is provided in selection, administration, and interpretation of selected instruments.
306. *Counseling Theory and Technique*. II, S. 3 hr. PR: C&G 303 and consent. A study of counseling approaches commonly used in public schools, colleges, and rehabilitation agencies. Application of theory emphasized.
308. *Organization and Development of Counseling and Guidance Services*. I, S. 2 hr. PR: C&G 303, 305, 306. Operation of guidance program in terms of personal functions, relationships, physical facilities, instructional integration, law and regulations. Consideration will be given to current professional issues.
309. *Group Counseling Theory and Techniques*. II, S. 3 hr. PR: Consent. Theories of group counseling and demonstrations of specific group techniques. Evaluation will be based on expertise in group facilitation.
310. *Introduction to Student Personnel Work in Higher Education*. I. 3 hr. PR: Consent. A historical and topical study of the development of student personnel structure and functions in higher education. (Course will not be offered in 1981-82.)
320. *Vocational Development and Occupational Choices*. II, S. 2-4 hr. PR: C&G 303. Principles and methods involved in vocational counseling. The use of occupational and educational information and theories of career development in vocational guidance.
330. *Elementary School Guidance*. I, S. 3 hr. PR: Consent. Practical application of the principles of guidance to the elementary school. (Course will not be offered in 1981-82.)
331. *Consultation Techniques*. I, II, S. 3 hr. PR: C&G 306 and consent. A specialized multiple training experience covering advanced theory, techniques and practices.

skill development in teacher, and parental consulting. (*Course will not be offered Fall, 1981-82.*)

382. *Special Topics*. I, II, S. 1-6 hr. PR: Advanced standing and consent. Independent study and directed readings in specialized areas of counseling and guidance.
385. *Practicum*. I, II, S. 1-12 hr. PR: Preregistration, liability insurance, cleared for graduation at close of semester, or M.A. degree, and consent of departmental practicum evaluation committee. An intensive supervised practical experience in the public schools or agencies, in counseling with individual critique and appropriate small group experiences. Demonstration of high professional standards, counseling skills, and personal characteristics appropriate to the counseling relationship are essential.
395. *Problem in Counseling and Guidance*. I, II, S. 1-12 hr. PR: Consent. Study and research for master's degree in counseling and guidance.
401. *Advanced Counseling Techniques*. I. 3 hr. PR: Consent. The comprehensive development of counseling techniques related to generic as well as specific theoretical models. Emphasis and evaluation will be based on student's ability to demonstrate techniques related to counseling in general, and a theoretical counseling model of their choice. In-setting laboratory experience required.
431. *Advanced Consultation Techniques*. I. 3 hr. PR: C&G 331 or equiv., or consent. Multiple training and experiences in theories and techniques of consultation and delivery of human services to educational and community personnel. Simulated classroom and laboratory experiences.
463. *Advanced Theories of Counseling*. II, S. 3 hr. PR: Practicum in counseling, admission to advanced graduate study, and consent. A comprehensive study of the theoretical issues in contemporary counseling.
464. *Individual Intelligence Testing and Interpretation*. I. 4 hr. PR: Advanced standing and preregistration with instructor (9 hr. psychology, and demonstration of proficiency in measurement needed for admission). Administering, scoring, and interpreting individual intelligence tests.
466. *Manpower Utilization and Development*. II. 3 hr. PR: Advanced standing and consent. Economic, social, and political implications of manpower utilization and the role of the counselor to assist with its pressing demands.
469. *Advanced Theory and Practice of Human Appraisal*. I, II. 3 hr. PR: C&G 305 and consent. Advanced study in the application of assessment procedures to analyze specific problems in counseling and guidance and consideration of alternative methods for measuring human behavior.
472. *Internship*. I, II, S. 1-12 hr. PR: Advanced standing and pre-registration with instructor. Designed to offer post-master's degree students an opportunity to practice, under close supervision, professional skills required in the broad field of counseling.
480. *Seminar*. I, II, S. 1-6 hr. PR: Advanced standing and consent. Seminar for certificate of advanced studies and doctoral students in counseling and guidance.
483. *Counseling Supervision Models*. II. 3 hr. PR: Advanced standing; consent. Overview of major assumptions and techniques of five major counseling supervision models. Multiple training activities include simulated and actual demonstrations of each of the supervision models and critique of the assumptions, advantages, and constraints of each model.
490. *Teaching Practicum*. I, II. 1-3 hr. PR: Consent. Intended for graduate students with college teaching responsibility.

491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced areas of Counseling and Guidance and Rehabilitation Counseling.
492. *Issues and Trends in Counseling and Psychotherapy*. I. 3 hr. PR: Advanced standing; consent. Overview of current ethical, legal, and professional issues in counseling, psychotherapy, and counselor education. Course includes readings, discussion, and a survey and written review of literature in a topic related to the practice and research of counseling.
493. *Seminar*. I, II, S. 1-6 hr. PR: Consent.
494. *Seminar*. I, II, S. 1-6 hr. PR: Consent.
495. *Seminar*. I, II, S. 1-6 hr. PR: Consent.
496. *Graduate Seminar*. I. 3 hr. PR: Advanced standing; consent. Written and oral presentation of methodology and results of one's own research study with supervision and critique by the instructor and members of the seminar.
497. *Research*. I, II, S. 1-15 hr. PR: Consent. Dissertation.
498. *Thesis*. I, II, S. 2-4 hr. PR: Consent.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not registered in regular course work but who have need to use University facilities for completion of their research or program.

ECONOMICS

Lewis C. Bell, *Director of Graduate Economics Program*
200 Armstrong Hall

Degrees Offered: M.A., Ph.D.

Graduate Faculty: Members Alvis, Bell, Britt, Dix, Elkin, Fogarty, Hwang, Kymn, Labys, Leyden, Mann, Page, Thompson, Witt, and Yi. Associate Member Hawley. (Graduate faculty for other options in economics may be found in Part 7.)

The purpose of the Master of Arts (M.A.) and Doctor of Philosophy (Ph.D.) degree programs in economics is to enable students to broaden and refine their knowledge of the concepts and methods of economic analysis. These programs are designed to prepare students for careers in business, government, and higher education. Student programs are planned with the assistance and approval of the Director of Graduate Programs in Economics. All graduate students must enroll in Economics 499, Colloquium, each semester in residence. Complete information about these graduate programs in economics, and the regulations and requirements pertaining to them, may be obtained by securing a copy of "Graduate Programs in Economics" from the Director of Graduate Programs in Economics. Students are bound by these regulations and requirements, as well as those in the *Catalog*.

Admission. To be admitted as a regular graduate student, applicants must have a grade-point average of 2.75 or better ($A = 4.0$) for all undergraduate work completed. Students are required to have completed 12 hours of economics. Students are expected to have taken the general aptitude portion and Economics advanced portion of the Graduate Record Examination. It is required that all applicants will have completed at least one semester of each of the following courses: intermediate microeconomic theory, intermediate macroeconomic theory, calculus, and statistics. Applicants not meeting the entrance requirements may be admitted on a provisional and/or deficiency basis subject to certain performance conditions during their first semester of residence.

Master of Arts (M.A.)

The Master of Arts (M.A.) degree program requires a total of 36 hours of graduate credit, including 21 hours in economics. At least 24 hours of the course work completed must be at the 300 level. To qualify for the M.A. degree, graduate students in economics must earn a cumulative grade-point average of 2.75 in all courses attempted as a graduate student at WVU. The M.A. program contains a thesis and a nonthesis option. Specific course requirements include:

Core Courses —

Economics 310 — Advanced Micro Theory I, 3 hr.

Economics 312 — Advanced Macro Theory I, 3 hr.

Economics 316 — History of Economic Doctrines and Analysis, 3 hr.

If the student has successfully completed Economics 216 (History of Economic Thought) or its equivalent before entering the graduate program, this requirement is satisfied.

Economics 220 — Introduction to Mathematical Economics, 3 hr.

Statistics Requirement (with Grade of B or better) —

Option A:

Statistics 261 — Statistics and Probability, 3 hr.

Option B — 6 hr.:

Statistics 361 and 362 — Theory of Statistics

Option C — 6 hr. from the following:

Economics 225 — Applied Business and Economics Statistics, 3 hr.

Economics 325 — Econometrics, 3 hr.

Statistics 231 — Sampling Methods, 3 hr.

Statistics 351 — Applied Regression Analysis, 3 hr.

Statistics 371 — Introduction to Exploratory Data Analysis, 3 hr.

Industrial Engineering 250 — Introduction to Operations Research, 3 hr.

Industrial Engineering 253 — Applied Linear Programming, 3 hr.

Thesis Option —

a. An acceptable thesis, 6 hr. Under the thesis option, the student must pass a final oral examination.

b. The following may be substituted for a thesis in meeting the requirements for the M.A.: (1) completion of two 300-level courses (minimum of 6 semester hours) in one field of concentration in economics; and (2) submit a research paper that gives evidence of substantial ability to conduct scholarly research.

Program Options

The M.A. program in economics includes special options conducted by the College of Business and Economics (B&E) jointly with other units on campus. These options include: Business Analysis, Energy Economics, Journalism and Economics, Law and Economics, Manpower Planning and Evaluation, Mathematical Economics, Public Policy, and Statistics and Economics. To earn the M.A. in economics, students must complete the M.A. core courses and fulfill other requirements pertaining to the particular option.

Business Analysis — Conducted in cooperation with the other departments of the College of Business and Economics, this option is designed to prepare students for a job in the business analysis area. In addition to the core courses for the M.A. in economics, students take 9 more hours of economics, and 12 hours of business courses: Managerial Control, Administrative Practices, Financial Administration, and Marketing Administration.

Energy Economics — Conducted in cooperation with the College of Mineral and Energy Resources (COMER), this option is designed to prepare students in the area of resource economics, including energy and environmental issues. Courses students take include: Economics of the Energy and Petrochemical Sectors, Theory and Policy of Mineral Economics, Models of Mineral Commodity Markets (COMER); and Energy Economics, and Environmental Economics (B&E). Students are required to submit three graduate papers.

Journalism and Economics — Conducted in cooperation with the School of Journalism, this option is designed to prepare journalism students to cover more effectively those stories involving economic problems and issues and economic students valuable knowledge and expertise in critical writing. The M.S. in journalism requires 30 hours of graduate work, with 12 of those in economics and 18 in journalism. The M.A. in economics requires 36 hours of graduate work, with 12 of those in journalism and 21 in economics, and 3 in statistics.

Law and Economics — Conducted in cooperation with the College of Law, this option is designed to enable students to develop a degree of expertise and knowledge in both law and economics. Law students may receive the M.A. in economics by combining their law courses with 24 hours of economics. The economics major may receive the M.A. by completing 21 hours of economics and 12 hours of law courses. The students must take the core courses in economics plus 9 hours of economics electives.

Manpower Planning and Evaluation — Conducted in cooperation with the School of Social Work (SSW), this option is designed to prepare students for jobs in the area of manpower planning and evaluation, especially in state and local government. For the M.A. in economics, students are required to complete two semesters of field placement. Courses students take include: Group Theory, Community Organization, Program Design and Evaluation (SSW); Manpower Economics, Seminar in Labor Economics, Accounting and Fiscal Management, Seminar in Manpower Planning (B&E).

Mathematical Economics — This option is conducted in cooperation with the Department of Mathematics (Math.). Students entering this option must previously have taken 12 hours in mathematics, including a course in Calculus equivalent to Math. 51. Courses students take include Advanced Micro Theory II, Advanced Macro Theory II, Quantitative Analysis, Mathematical Economics, Seminar in Mathematical Economics, Introduction to Linear Algebra, and Introduction to Real Analysis.

Public Policy — Conducted in cooperation with the Department of Political Science (PS), this option is designed to provide students with sufficient analytical and research skills to become competent researchers, particularly with regard to public policy problems. Field training on an optional basis may be obtained through a research residency or internship in a public agency. Courses include Politics of Planned Development, Theory of Public Policy Development, Seminar in Policy Development, Political Science Methodology (PS); and economics electives selected on the basis of the student's special interests. For the M.A. degree in economics, students must complete 21 hours in economics, including the core.

Statistics and Economics — Conducted in cooperation with the Department of Statistics and Computer Science (Stat.), this option is designed to prepare students for employment, in the public or private sector, which demands the use of quantitative skills. Courses include Statistics and Probability, Applied Regression Analysis (Stat.), and Econometrics (B&E).

Doctor of Philosophy (Ph.D.)

At least three years of full-time graduate work beyond the baccalaureate degree are usually required to qualify for the doctorate. A minimum of two consecutive semesters in actual residence as a full-time graduate student is required. To qualify for the Doctor of Philosophy (Ph.D.) degree in economics, students must earn a cumulative grade-point average of 3.0 in courses completed at WVU.

The Ph.D. degree is not awarded for the mere accumulation of course credits nor for the completion of the specified residence requirements. All students are required to complete the graduate core curriculum, prepare themselves in three fields of concentration other than economic theory, fulfill a language requirement, and submit an acceptable dissertation. A minimum of 36 hours of graduate work in economics at the 300 level is required for all candidates for the Ph.D. degree in economics.

Core Courses:

Economics 310 — Advanced Micro Theory I, 3 hr.

Economics 311 — Advanced Micro Theory II, 3 hr.

Economics 312 — Advanced Macro Theory I, 3 hr.

Economics 313 — Advanced Macro Theory II, 3 hr.

Economics 316 — History of Economic Doctrines and Analysis, 3 hr.

(Grade of "B" or better required for Economics 316.)

Economics 320 — Mathematical Economics, 3 hr.

Economics 325 — Econometrics, 3 hr.

Statistics 261 — Statistics and Probability, 3 hr.

The student can waive the statistics and econometrics requirement by successful completion of qualifying examinations or by successful completion of Economics 326 (grade "B" or better).

Fields of Concentration. Six semester hours (or the equivalent) must be taken in each of the student's three fields of concentration. Areas of concentration include: econometrics, monetary economics, public finance, public regulation and control, international economics, regional and urban economics, labor economics, economic history, and energy and environmental economics. One of the fields of concentration may be in an outside area (the selection must be approved by the graduate economics faculty).

Language Requirement. Students must demonstrate the ability to read one foreign language or pursue additional specified course work in computer science, philosophy, mathematics, statistics, or other approved fields. An acceptable foreign language is one in which there exists a significant literature in economics and which is approved by the Dean of the Graduate School. For alternatives to satisfying the foreign language requirement, see departmental regulations — "Foreign Language Options."

Comprehensive Examinations. Students must pass written comprehensive examinations in economic theory (microeconomics and macroeconomics) and three fields.

Candidacy and Dissertation. When an applicant has successfully passed the written comprehensive examinations, the applicant will be formally promoted to candidacy for the Ph.D. degree. The candidate must submit a dissertation pursued under a member of the graduate faculty in economics on some problem in the area of the candidate's major interest. The dissertation must present the results of the candidate's individual investigation and must embody a

definitive contribution to knowledge. It must be approved by a committee of the graduate faculty in economics. After approval of the candidate's dissertation and satisfactory completion of other graduate requirements, a final oral examination on the dissertation is required.

Ph.D. Program Options

The Ph.D. program includes special options conducted in cooperation with other units on campus. These include Agricultural Economics, Energy Economics, Industrial Relations, Management and Marketing, and Mathematical Economics. The options specify certain concentrations of course work and comprehensive examinations. Acceptable dissertations are required of all students.

Agricultural Economics — The Agricultural Economics option is conducted in cooperation with the College of Agriculture and Forestry. In addition to the core theory courses (24 hours), students are required to take at least 12 semester hours (at least 9 hours of this at the 300 or above level) in the area of agricultural economics, as approved by the Division of Resource Management faculty.

In addition to Economics 325, Econometrics, students must take 6 additional hours of econometrics, including Economics 329, Seminar in Econometrics.

Beyond the core courses, econometrics, and the area of agricultural economics, students must have an additional field in economics. This field consists of 6 semester hours at the 300-level or higher.

The language requirement is the research option as set forth within the economics Ph.D. program. The comprehensive examinations are taken in each field, including the Economic Theory core. The examination in agricultural economics is prepared and administered by the agricultural economics faculty.

Energy Economics — Conducted in cooperation with the College of Mineral and Energy Resources (COMER), the Energy Economics option is designed for students wishing to specialize in the area of energy, resource, and environmental economics. In addition to the core theory courses, students are expected to complete a field (12 semester hours at the 300-level) in Mineral Resource Economics (COMER), and fields in Energy and Environmental Economics and Econometrics in the Department of Economics. One field in the Department of Economics may be substituted for Econometrics, provided the student successfully completes Economics 325.

Industrial Relations — Graduate work in Industrial Relations typically is interdisciplinary in nature. The Ph.D. option retains this orientation while providing students with a sound understanding of economic theory and analysis. A minimum of 48 hours of graduate work is required, including the following core courses:

- Economics 310 — Advanced Micro Theory I
- Economics 312 — Advanced Macro Theory I
- Economics 220 — Introduction to Mathematical Economics
- Economics 491 — Special Topics: Economic Organization Theory
- Law 371 — Labor Law I
- Economics 362 — Advanced Collective Bargaining
- Industrial Relations 491 — Industrial Relations Research
- Industrial Relations 497 — Practicum in Industrial Relations

Students must demonstrate proficiency in the use of statistical techniques. Six hours are required:

Statistics 312 — Statistical Methods, and one course from among the following:

- Statistics 341 — Multivariate Analysis
- Statistics 351 — Applied Regression Analysis
- Statistics 381 — Nonparametric Statistics
- Economics 325 — Econometrics

Students are required to complete three fields of concentration other than Industrial Relations Theory (core). One field must be Labor Economics and two other fields may be selected from Economics, Industrial Psychology, Public Administration, Statistical Analysis, Personnel Management, Industrial Engineering, or Law. Students must take 6 hours of course work at the 300-level (beyond the core) in each of these fields and successfully pass a written comprehensive in each field. A two-part comprehensive is also required in Industrial Relations Theory.

Management and Marketing — Conducted in cooperation with the Department of Management and Marketing, the Management and Marketing option is designed for those students wishing greater concentration in the business area than the traditional Ph.D. route in economics affords. The required graduate core, consisting of 39 hours and including either the Management or Marketing core, is as follows:

Core Curriculum:

Economics, Research Methods

- Economics 220 — Introduction to Mathematical Economics, 3 hr.
- Economics 310 — Advanced Micro Theory I, 3 hr.
- Economics 312 — Advanced Macro Theory I, 3 hr.
- Economics 491 — Advanced Study — Economic Organization:
Decision Making and Markets
- Industrial Relations 491 — Advanced
Study — Industrial Relations Research, 3 hr.
- Management 302 — Quantitative Business Analysis
- Management 491 — Advanced Study — Research Methodology, 3 hr.

Management Graduate Core

- Management 301 — Organizational Theory, 3 hr.
- Management 305 — Organizational Development
- Management 313 — Production Administration
- Management 316 — Advanced Personnel Management
- Management 323 — Administrative Policy
- Management 329 — Advanced Management Seminar

Marketing Graduate Core

- Marketing 211 — Marketing Management
- Marketing 313 — Marketing Administration
- Marketing 314 — Management of Product Development
- Marketing 315 — Management of Distribution Systems
- Marketing 323 — Administrative Policy
- Marketing 329 — Advanced Marketing Seminar

In addition to the core, students are required to take 6 hours in each of two fields at the 300 or above level. One of these additional fields must be in economics. These fields and appropriate course work are selected by the student, subject to the approval of the Director of Graduate Programs in Economics.

Students must demonstrate proficiency in the use of statistical techniques. In addition to the core courses, students must take 3 hours in one of the following:

- Statistics 341 — Applied Multivariate Analysis
- Statistics 351 — Applied Regression Analysis
- Statistics 381 — Nonparametric Statistics
- Economics 325 — Econometrics.

Proficiency may be demonstrated by taking a qualifying examination or by obtaining a "B" or better in each course.

The language option is the traditional research option or a foreign language.

Students must pass written comprehensive examinations in the core (Economic Theory and Management or Marketing) and the two other approved fields of concentration. The examining committees are comprised of faculty from the relevant fields as set forth in procedures in the office of the Director of Graduate Programs in Economics.

Mathematical Economics — The Mathematical Economics option is conducted in cooperation with the Department of Mathematics. To be admitted into this option, students must have completed a minimum of 12 hours in mathematics, including a course in calculus equivalent to Mathematics 51. In addition to the Economics Ph.D. core, students are required to take the following courses:

- Economics 326 — Econometrics II
- Economics 328 — Advanced Mathematical Economics
- Mathematics 241 — Introduction to Linear Algebra
- Mathematics 251, 252 — Introduction to Real Analysis
(Mathematics 251 and 252 may be replaced by Mathematics 317, 318.)
- Mathematics 490 — Seminar in Mathematical Economics
- Mathematics Elective — 3 hr.

Students are required to successfully complete comprehensive examinations in economic theory, mathematical economics, econometrics, and one other field in economics or mathematics.

Economics (Econ.)

Specialized Courses

- 200. *Special Topics*. I, II, S. 1-4 hr. PR: Econ. 52 or 55 or consent. Special topics relevant to economics. Maximum of 9 semester hours in any or all courses numbered 200 offered by the College of Business and Economics may be applied toward bachelor's and master's degrees.
- 205. *Current Economic Problems*. S. 3 hr. PR: Econ. 52 or 55 or consent. For students in education only. Acquaints school teachers with reliable source materials in economics and instructs them in studying current economic problems.
- 297. *Internship*. I, II, S. 1-12 hr. PR: Econ. 52 or 55 and departmental approval. Field experience in the analysis and solution of economic problems in the public and private sectors.
- 301. *Managerial Economics*. II. 3 hr. PR: Econ. 54. For students in the M.B.A. program. Analysis of markets and problems of management in appraising business conditions and in adjusting to changes in product demand, costs, level of output, and profits.

302. *Research and Reports. I, II. 1-3 hr.* For students in the M.B.A. program. Sources of business information and research procedures, with application in preparation of reports. *(Course will not be offered in 1981-82.)*

Economic Theory

211. *Micro Economic Analysis. I or II. 3 hr.* PR: Econ. 52 or 55. Price and output determination and resource allocation in the firm under various competitive conditions.
212. *Macro Economic Analysis. I, II. 3 hr.* PR: Econ. 52 or 55. Forces which determine the level of income, employment, and output. Particular attention to consumer behavior, investment determination, and government fiscal policy.
216. *History of Economic Thought. I or II. 3 hr.* PR: Econ. 52 or 55. Economic ideas in perspective of historic development.
310. *Advanced Micro Theory I. I. 3 hr.* Theory of production and allocation, utility theory, theory of the firm, pricing in perfect and imperfect markets, models of firm's operations.
311. *Advanced Micro Theory II. II. 3 hr.* PR: Econ. 310. General equilibrium analysis, distribution theory, welfare economics.
312. *Advanced Macro Theory I. II. 3 hr.* Classical, Keynesian, and Post-Keynesian theories.
313. *Advanced Macro Theory II. I or II. 3 hr.* PR: Econ. 312. Model of economic growth and fluctuations.
316. *History of Economic Doctrine and Analysis. I. 3 hr.* Writings of the major figures in the development of economic doctrines and analysis.
319. *Seminar in Economics. I or II. 3 hr.*

Quantitative Economics

220. *Introduction to Mathematical Economics. I or II. 3 hr.* PR: Math. 15 or 128, and Econ. 52 or 55; or consent. Principal mathematical techniques including set operation, matrix algebra, differential and integral calculus employed in economic analysis. Particular attention given to static (or equilibrium) analysis, comparative-static analysis and optimization problems in economics.
225. *Applied Business and Economic Statistics. I, II. 3 hr.* PR: Econ. 125 or Stat. 101 or consent. Continuation of Econ. 125. Principle statistical methods used in applied business and economic research including multiple regression, index numbers, time series analysis, forecasting models and methods, and sampling design.
320. *Mathematical Economics. II. 3 hr.* PR: Econ. 220 or consent. Linear programming, input-output analysis, complex numbers, linear difference and differential equations, comparative-static and dynamic analysis and optimalization techniques.
325. *Econometrics I. II. 3 hr.* PR: Stat. 262 or 264 or consent. Specification, estimation, and verification of single equation economic models. Topics covered include multicollinearity, autocorrelation, heteroscedasticity, dummy variables, time series analyses and forecasting, functional form, and specification error analysis. Students should be familiar with matrix algebra.
326. *Econometrics II. I. 3 hr.* PR: Econ. 325 or consent. Identification and estimation of simultaneous equation models and their use in forecasting and simulation. Other advanced topics include distributed lags, autoregressive models, errors in variables models, aggregation problem, and pooled cross-section/time-series models.
328. *Advanced Mathematical Economics. I or II. 3 hr.* PR: Consent. Mathematical properties of microeconomic models of general equilibrium and welfare, existence, uni-

queness, and stability of equilibrium. Applications of Hamiltonian and maximum principles to growth models and economic control problems. Investigation of separability theorems.

329. *Seminar in Econometrics*. I or II. 3 hr.

Monetary Economics

330. *Monetary Economics*. I or II. 3 hr. Sources and determinants of supply of money; demand for money for transactions and speculative purposes; general equilibrium theory of money, interest, prices, and output; role of money in policy.
334. *Seminar in Monetary Economics*. I or II. 3 hr.

Public Finance

241. *Public Finance*. I, II. 3 hr. PR: Econ. 52 or 55. Governmental fiscal organizations and policy; taxes and tax systems with particular emphasis on federal government and state of West Virginia.
340. *Theory of Public Finance*. I or II. 3 hr. Economic role of government in a mixed economy with regard to resource allocation between public and private sectors, influence of government upon income distribution and economic stability and growth.
344. *Seminar in Public Finance*. I or II. 3 hr.

Public Regulation and Control

245. *Government and Business*. I, II. 3 hr. PR: Econ. 52 or 55. Market structure, conduct and performance: analysis of the antitrust laws — judicial interpretation and effect on the business sector.
246. *Transportation*. I, II. 3 hr. PR: Econ. 52 or 55. Development of an inland transportation system and relations and policies of transport agencies.
345. *Industrial Organization*. I or II. 3 hr. Economic analysis of market structure, conduct and performance: in-depth evaluation of markets and industries in the United States and the effect of government intervention on firm behavior.
349. *Public Regulation of Business*. I or II. 3 hr. Economic analysis of regulation of specific industries such as public utilities.

International Economics

250. *International Economics*. I or II. 3 hr. PR: Econ. 52 or 55. Development of trade among nations; theories of trade, policies, physical factors, trends, and barriers in international economics.
350. *Advanced International Economics*. I or II. 3 hr. Contemporary theories of international economics; analysis of current problems in world trade and finance.
354. *Seminar in International Economics*. I or II. 3 hr.

Regional Economics

255. *Regional Economics*. I. 3 hr. PR: Econ. 52 or 55. Analysis of the regional economy's spatial dimension, emphasizing interregional capital and labor mobility, the role of cities, objectives and issues of regional policy, lagging regions and Appalachia, growth poles, and regional growth and income distribution.
257. *Urban Economics*. II. 3 hr. PR: Econ. 52 or 55. Analyzes the spatial dimensions of the urban economy, emphasizing both urban economic theory and urban policy.

Issues include cities and income inequality, urban upgrading function, blight, economics of ghettos, the economics of urban size.

355. *Advanced Regional Economics*. I or II. 3 hr. Regional income and flow of funds estimation, regional cyclical behavior and multiplier analysis, industrial location and analysis, techniques of regional input-output measurement, impact of local government reorganization on regional public service and economic development.
357. *Advanced Urban Economics*. II. 3 hr. Analyzes the spatial dimensions of the urban economy, emphasizing urban theory, policy, and empirical research. Major subjects include urban income distribution, residential location theory, spatial structure, neighborhood change, blight, ghettos, segregation, renewal, and city size.
359. *Seminar in Regional Economics*. I or II. 3 hr.

Labor Economics

260. *Human Resource Economics*. I or II. 3 hr. PR: Econ. 160 or consent. Economics and institutional forces determining the level and composition of labor supply and demand; labor mobility; governmental manpower policies.
262. *Collective Bargaining*. I or II. 3 hr. PR: Econ. 160 or consent. Theory and practice of collective bargaining; contract issues, types of relationships, and role of government policy.
263. *Labor Market Analysis*. I or II. 3 hr. PR: Econ. 160 or consent. Determination of wage levels and structure; economic and institutional forces determining wage levels and differentials.
360. *Advanced Human Resource Economics*. I or II. 3 hr. Examination and analysis of our social and economic efforts to solve current manpower problems in the U.S., including structural unemployment and inflation.
362. *Advanced Collective Bargaining*. I. 3 hr. PR: Econ. 262 or consent. Development of the economic theory, empirical analysis and policy implications of the impact of collective bargaining on wages, employment, market structure, and prices.
364. *Seminar in Labor Economics*. I or II. 3 hr.

Economic History

270. *Growth of the American Economy*. I or II. 3 hr. PR: Econ. 52 or 55. Central issues in development of the American economy.
370. *Economic History*. I or II. 3 hr. Examination of the methods of research and issues in economic history of the United States. (Course will not be offered in 1981-82.)
374. *Seminar in Economic History*. I or II. 3 hr. (Course will not be offered in 1981-82.)

Economic Development

213. *Economic Development*. I or II. 3 hr. PR: Econ. 52 or 55. The problems, changes, and principal policy issues faced by non-industrialized countries in economic development.

Energy and Environmental Economics

380. *Energy Economics*. I. 3 hr. Welfare analysis of supply interruptions and the foreign dependence question. Study of various energy resources in reference to policy alternatives under variant growth conditions and input-output models. Examination of coal industry and coal externalities.

384. *Environmental Economics*. II. 3 hr. Examination of the theoretical and empirical literature dealing with externalities (pollution), the relationships between pollution and social costs, the relationship between energy production and environmental quality, and the optimal strategies for pollution abatement.

Other Economics Courses

390. *Independent Reading in Economics*. I or II. 3-6 hr. Supervised readings in special areas.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent.
497. *Research*. I, II, S. 1-15 hr.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent.

EDUCATION

William G. Monahan, *Dean of the College of Human Resources and Education*
802 Allen Hall

Degrees Offered: C.A.S., Ed.D.

Graduate Faculty: Members Albrink, Andes, Bailey, Baker, Bell, Blaskovics, Bower, Brisbane, Budig, Carline, Carlton, Clements, Cone, L. S. Cormier, W. H. Cormier, Couch, Davis, Delo, DeVore, Douglas, Elkins, England, Erickson, Fairbanks, Fehl, Fraley, W. K. Franz, Gautier, Goeres, Goodwin, Hatcher, Head, Helfeldt, Holtan, Horacek, Hursh, Ianonne, Jacobs, Kelly, Kurucz, Lass, Lawrence, Lilley, Lombardi, Love, McAvoy, O. C. McGhee, P. R. McGhee, Majumder, Marcum, Marinelli, Martin, Masson, Meckley, Messing, Monahan, Moxley, Murphy, Murray, A. H. Nardi, G. A. Nardi, Nomani, Obenauf, O'Palka, Parker, Paterson, Phillips, Plants, Platt, R. L. Redick, S. S. Redick, Ribovich, Saltz, Sears, Shultz, Simon, E. R. Smith, Srebalus, Stead, D. W. Sunal, Tseng, Tunick, E. A. Vargas, J. S. Vargas, Wales, Walls, Wesolowski, Williams, Yeazell, Yost, and Yura. *Associate Members* Ahrens, Bodenhemier, Carlin, Deay, DePue, Eisele, Grasso, Greever, J. L. Guthrie, Hartnett, Hobbs, Howard, Kaczmarek, McCrory, McDonald, Marsicano, Meadowcroft, Moriarty, Orelove, Pearson, Pytlik, Ramsey, D. Rauch, Ruscello, A. R. Sack, Shuck, P. K. Smith, Solomon, St. Louis, C. C. Sunal, Taylor, Tekieli, Venjohn, Venable, Weibels, Wienke, Wilhelm, and J. Yeager.

Certificate of Advanced Study (C.A.S.)

This program is designed to prepare school and related personnel who wish professional training beyond the master's degree. Candidates for the Certificate of Advanced Study in Education may choose from among the following areas of study for their area(s) of concentration: (a) Administration and Supervision; (b) Curriculum and Instruction; (c) Counseling and Guidance; (d) Reading; (e) Special Education; (f) Physical Education, and (g) Safety Studies. Persons interested in the certificate should consult with the chairperson of the appropriate department or the Dean of the College of Human Resources and Education.

Doctor of Education (Ed.D.)

The program of study leading to the degree of Doctor of Education (Ed.D.) is planned with the student's graduate adviser and committee and is made available through the faculty and support services of the College of Human Resources and Education. It combines courses of instruction, seminars, super-

vised research, and ancillary experience intended to provide the candidate with a variety of educationally related competencies. Special requirements, such as tools of research, also may be specified by the student's committee. All the requirements for the degree are to be completed within a period of seven years.

The Ed.D. is a program based on competencies and thus given may provide a broad overview of education or it might delve very deeply into a single aspect. Thus it is possible for a student to study physical education under the supervision of the graduate faculty in the College of Human Resources and Education in cooperation with the graduate faculty in the School of Physical Education to form committees for those interested in physical education or safety studies, and with the College of Engineering graduate faculty for studies in engineering education. College facilities and faculty expertise make it possible for students wishing to do so to concentrate more heavily in such fields as curriculum development, counseling and guidance, education administration, educational psychology instruction, health education, rehabilitation services, special education, speech pathology and audiology, and technology education.

A more extensive description of the Ed.D. can be found in the College of Human Resources and Education section in Part 3 of the *Graduate School Catalog*.

EDUCATION ADMINISTRATION

James A. Martin, *Chairperson of the Department*
1140 Agricultural Sciences Building

Degrees Offered: M.A., Ed.D.

Graduate Faculty: Members Andes, Bell, Brisbane, Budig, Gautier, Goeres, Goodwin, Lilley, Martin, Meckley, Monahan, and Smith. Associate Members Hartnett and Taylor.

The Department of Education Administration offers graduate programs leading to the degrees of Master of Arts, Certificate of Advanced Study, and Doctor of Education, as well as professional preparation for certification in principalship, supervision, and superintendency. All students are assigned an adviser upon acceptance into the department. All students are to contact their advisers for specific program and certification requirements.

Admission Requirements. Applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Education Administration. Admission to all programs is contingent on assessment of: (1) complete official transcripts of all higher-education work attempted, and (2) other evidence the faculty may deem necessary to judge probable success in the graduate program.

Master of Arts

Optional programs are available in public school administration and supervision, higher education administration, as well as extension and continuing education. A two-semester, field-based experience is required before permanent professional certification can be acquired in public school administration and supervision. In order to graduate, the student must earn at least a 3.25 grade-point average on all program work attempted.

Certificate of Advanced Study

Advanced work beyond the master's degree may be taken with emphasis in school district central office administration or in principalship. A research project or a 6-hour planned field-based experience is required. In order to graduate, the student must defend the research project and earn at least a 3.25 grade-point average on all program work attempted.

Doctor of Education

The Doctor of Education degree is offered with emphasis on public school administration, higher education or major education organizations — such as state departments of education. Within the regulations of the Graduate School, the College of Human Resources and Education, and the Department of Education Administration, each program is individually designed by the doctoral student, the student's adviser, and the doctoral committee to meet the student's career aspirations.

Education Administration (Ed. A.)

- 300. *Public School Organization and Administration*. I, II, S. 3 hr. Basic concepts through which administrators, supervisors, and teachers gain understanding of general problems related to operation of schools and school systems.
- 318. *School Business Administration*. I, II, S. 3 hr. PR: Consent. Sound business administration for central office and attendance center school administrators.
- 320. *Personnel Administration*. I, II, S. 3 hr. PR: Consent. The determination of student, employee, and organizational personnel needs and the development of plans and programs to meet these needs.
- 330. *Principles of Education Leadership*. I, II, S. 3 hr. PR: Consent. Problems of school leaders in the areas of administration, supervision, and instruction.
- 331. *Principles of Supervision*. I, II, S. 3 hr. PR: Consent. Elementary, junior high, and senior high supervision.
- 333. *School Law*. I, II, S. 3 hr. PR: Consent. Overview of the generally accepted legal principles which affect the student, teacher, and principal in a public school setting.
- 351. *Administrative Procedures in Adult Education*. I, II, S. 3 hr. PR: Consent. Theories and principles of administering adult education organizations as they relate to planning, organizing, staffing, initiating, delegating, integrating, motivating, decision making, communicating, establishing standards, financing, and budget defense and control, and measuring results. (*Offered off-campus only.*)
- 352. *Professionalism in Extension Service*. II, S. 3 hr. PR: Consent. Role of Extension Service professionals in social change, study community systems; professional relationships, accountability; ethics, obligations to clientele. (*Offered off-campus only.*)
- 353. *Community Education: Administration and Organization*. I. 3 hr. PR: Consent. Study of the rationale, methods, and procedures in administering and programming community education. Experiences in planning, adapting, and evaluating programs independently and in consort with school and community plans. (*Offered off-campus only.*)
- 354. *Management of Youth Development Programs*. II, S. 3 hr. PR: Consent. Study of the management of youth programs. Emphasis on relationships of management principles to program development, youth needs, work plans, curriculum, resources, and evaluation. (*Offered off-campus only.*)

355. *Leadership Development for Youth Programs*. I, II, S. 3 hr. PR: Consent. Fundamentals of administrative leadership development in youth programs. An overview analysis of the tools, tasks, and competencies with emphasis in group dynamics in developing leadership skills of volunteers. *(Offered off-campus only.)*
373. *Professional Development*. I, II, S. 1-6 hr. PR: Department approval. Specially designed experiences for those interested in advancing professional skills in a particular specialty. May be repeated. Not for degree credit in programs in the College of Human Resources and Education.
385. *Practicum*. I, II, S. 1-12 hr. PR: Consent.
388. *Research-Evaluation-Assessment*. I, II, S. 3 hr. PR: Consent. Research, assessment, and evaluation procedures related to administrative decision making and problem solving to increase the general effectiveness of educational institutions.
389. *School-Community Relations*. I, II, S. 3 hr. PR: Consent. A study of the systems through which the school can be interpreted to its community public.
401. *Principalship*. I, II, S. 3 hr. PR: M.A. in education administration, or equiv., or consent. School building administration emphasizing planning, policy formulation, decision making, and managerial practices. *(Not offered every semester.)*
402. *Superintendency*. I, II, S. 3 hr. PR: M.A. in education administration, or equiv., or consent. Roles, relationships, behaviors, and competencies which characterize the school superintendent and staff. *(Offered in Fall and Summer, odd years.)*
403. *Education Administration Theory*. I, II, S. 3 hr. PR: M.A. in education administration, or equiv., or consent. Interdisciplinary study of the major concepts of education administration theory and the application to educational settings.
404. *Economics of Public Education*. I, II, S. 3 hr. PR: M.A. in education administration, or equiv., or consent. Basic concepts. *(Offered in Spring, even years.)*
405. *Administration of Educational Facilities*. I, II, S. 3 hr. PR: M.A. in education administration, or equiv., or consent. The planning, evaluation and management of current and future school facilities.
406. *Public Education and the Law*. S. 3 hr. PR: M.A. in education administration or equiv., or consent. Legal permissives and limitations involved in setting policy for organization of, and administration of public schools. *(Offered in Fall and Summer, even years.)*
407. *Collective Bargaining in Public Education*. II. 3 hr. PR: M.A. in education administration, or equiv., or consent. This course is designed to inform school administrators about the concepts and principles of negotiating and implementing collective bargaining agreements. *(Offered in Spring, even years.)*
408. *Organizational Analysis*. I. 3 hr. PR: M.A. in education administration, or equiv., or consent. An examination of alternative means for the analysis of organizational structures, interrelationships and functions. A field analysis is required.
409. *Politics of Education*. II. 3 hr. PR: M.A. in education administration or equiv., or consent. An examination of the internal political nature of school systems, and of the external influence of legislative, judicial and administrative bodies, and of interested groups. *(Offered in Spring of odd years.)*
458. *College Business Management*. I. 3 hr. PR: M.A. in education administration, or equiv., or consent. Covers knowledge of such areas as budgeting, grants and contracts preparation and administration, formula funding, management information systems, purchasing procedures and practices, and zero base budgeting.

459. *Adult and Continuing Education*. I, II, S. 3 hr. Principles, concepts, and processes involved in programming for adults in a community setting. Nature of adult learning, subject matter, and learning environment. (Offered in Summer of even years.)
460. *Development of Administration in American Higher Education*. I, II, S. 3 hr. The administrative development of American higher education from 1636 to the present, including internal trends and external forces. (Offered in Fall, 1981-82.)
461. *Higher Education Administration*. I, II, S. 3 hr. Organization and administration of higher education institutions. (Offered in Fall, 1981-82.)
462. *Higher Education Law*. I, II, S. 3 hr. Critical legal issues of higher education — public and private — using a case study approach. (Offered in Spring, 1981-82.)
463. *Higher Education Finance*. I, II, S. 3 hr. Financial concerns in higher education with emphasis on taxation and legislative actions, sources of income, budgeting, and cost analysis. (Offered in Spring, 1981-82.)
464. *Issues in Higher Education*. I, II, S. 3 hr. Current societal and institutional issues which tend to shape the mission and life style of an institution. (Offered in Fall of even years.)
465. *Institutional Research and Planning*. I, II, S. 3 hr. Accumulation, analysis, and interpretation of data relevant to decision making and the allocation of institutional resources. (Offered in Spring of even years.)
466. *The College Student*. I, II, S. 3 hr. Review of research and literature on college students from freshman through graduate school. Emphasis on student subcultural patterns. (Offered in Summer of odd years.)
467. *Higher Education Collective Bargaining*. I, II, S. 3 hr. The process and content of collective bargaining in higher education and its impact on institutional governance and academic jurisdictions. (Offered in Spring of even years.)
468. *Community and Junior Colleges*. I, II, S. 3 hr. Development, role, functions, organization, and curriculum of community and junior colleges in the United States, with special emphasis on West Virginia. (Offered in Summer of even years.)
469. *Higher Education Internship*. I, II, S. 3 hr. (May be repeated for credit.) Practical experiences in the administration of an organizational unit under supervision of the unit's chief administrator.
470. *Principal's Planned Field-Based Experience*. I, II. 3 hr. PR: Three years of successful experience as a teacher and have a position as principal or assistant principal. Consists of problem-solving techniques and seminar-types of activities as applied to explicit problems in the professional environment. Required for permanent certification as a principal.
471. *Supervisor's Planned Field-Based Experience*. I, II. 3 hr. PR: Three years of teaching experience, 15 hours completed in a master's degree program, and be employed full-time as a supervisor. Consists of problem-solving techniques and seminar-types of activities as applied to explicit problems in the professional environment. Required for permanent certification as a supervisor.
472. *Superintendent's Planned Field-Based Experience*. I, II. 3 hr. PR: Five years of successful experience as a teacher or supervisor, and employed as a superintendent or assistant superintendent. Consists of problem-solving techniques and seminar-types of activities as applied to explicit problems in the professional environment. Required for permanent certification as a superintendent.
480. *Seminar*. I, II. S. 1-6 hr. PR: Consent.
485. *Special Topics*. I, II, S. 1-6 hr. PR: Consent.

490. *Teaching Practicum*. I, II, S. 1-3 hr. PR: Consent. Supervised practices in college teaching.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
496. *Graduate Seminar*. I, II, S. 1 hr. PR: Consent.
497. *Research*. I, II, S. 1-15 hr. PR: Consent.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in its academic and cultural programs.

EDUCATIONAL PSYCHOLOGY

Benjamin H. Bailey, *Chairperson of the Department*
508 Allen Hall

Degrees Offered: M.A., Ed.D.

Graduate Faculty: Members Bailey, Baker, Cone, Fraley, Hursh, McAvoy, A. H. Nardi, Paterson, Stead, E. A. Vargas, J. S. Vargas, Walls, Wesolowski, and Williams. Associate Members Ahrens, Grasso, Howard, and Meadowcraft.

Educational Psychology offers areas of emphasis leading to the Master of Arts (M.A.) and the Doctor of Education (Ed.D.) degrees. There are three program options for both the M.A. and Ed.D. degrees. These options are: (1) Behavioral Analysis in Human Resources; (2) Learning and Development; and (3) Quantitative Methods of Education.

Professionals are trained in these programs for positions at all levels of education. These include university or college teaching and research; leadership positions in school districts, state departments of education, and federal agencies; industry; and private foundations.

Masters and doctoral programs are planned jointly by the student, the student's adviser, and the student's committee to meet the particular career needs of the student. Minor fields of study are also planned for each student as appropriate.

Additional Admission Requirements

Students may apply to a program at any time during the year. In order to be considered for the first semester, a student should have the application completed by March 15. For the second semester the deadline is November 1, and for the summer the deadline is March 15. Students will be notified of acceptance or nonacceptance.

For information write: Chairperson, Department of Educational Psychology, Human Resources and Education, 508 Allen Hall, Morgantown, WV 26506.

Graduate Program Options

Behavioral Analysis in Education — The Behavioral Analysis in Human Resources program option approaches problems in education from a behavioral science perspective. This program emphasizes: (a) the analysis of human resource settings into their observable components; (b) identification of environmental variables which govern the behavior of persons in human resource

settings; and (c) the design and implementation of strategies to manipulate those variables and produce changes in behavior. The curriculum features courses in the conceptual, experimental, and applied domains of behavior analysis. Course work involves the study of basic behavioral science and philosophy, including verbal behavior, analysis and modification of behavioral engineering, and complex systems for teaching. Students in this program option take additional course work in administration and management, systems, and other areas useful for positions of leadership.

Learning and Development — The Learning and Development program option approaches learning from the broad base of educational psychology. The central emphasis of this specialization lies in the integration of behavioral and developmental components for the study and analysis of human behavior. Students are trained for professional positions in educational as well as human-service settings. Course work involves the study of development and learning in both theoretical and applied areas.

Quantitative Methods — The Quantitative Methods program option approaches education from an applied research perspective. This program emphasizes: (a) a scientific approach to the collection and analysis of data; (b) identification and collection of data which are relevant to the solution of problems in education; and (c) the formulation and implementation of strategies which will facilitate sound decisions. Course work involves the study of research methodology, measurement and evaluation techniques, statistical procedures, program evaluation, and foundations of education.

Degree Requirements

The Department of Educational Psychology follows the general guidelines of the College of Human Resources and Education for the M.A. and Ed.D. degrees. In addition to the general requirements of the college, there is a core of courses required of all doctoral students in the department. The core consists of 3 credit hours in each of the following areas: (a) Educational Foundations and Curriculum; (b) Quantitative Methods in Education; (c) Behavioral Analysis in Education; and (d) Learning and Development.

Educational Psychology (Ed. P.)

231. *Sampling Methods*. I. 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single- and multi-stage sampling procedures. (Not offered in Fall, 1981-82.)
260. *Instructional Media and Technology*. I, II, S. 3 hr. The development of competencies in the use and construction of visual material and the technology for its utilization with various instructional procedures. Emphasis is on actual production and laboratory experience.
269. *Behavioral Technology for Education*. I, II, S. 3 hr. PR: Ed. P. 105 recommended. Behavioral science applied to instructional systems. Complex systems; feedback loops; measuring relevant variables, collecting data. Applying schedules of reinforcement. Effective stimulus control for students, and administrators. Relationship between system and institution. Behavioral ethics.
300. *Advanced Educational Psychology*. I, II, S. 3 hr. Design for beginning graduate students. Psychological principles of learning and development as they relate to processes of classroom instruction.

311. *Statistical Methods 1*. I, II, S. 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence, intervals, regressions, correlation, transformation, F and X^2 distributions, analysis of variance and sample size.
312. *Statistical Methods 2*. I, II, S. 3 hr. PR: Stat. 311. Extension of basic concepts of statistical models, design of experiments, multiway classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics. (*Course not offered in Fall, 1981-82.*)
320. *Introduction to Research*. I, II, S. 3 hr. PR: Ed. P. 311. Methods and techniques of research in education. Major emphasis on design, analysis, interpretations, and reporting of research.
321. *Design of Experiments*. I, II, S. 3 hr. PR: Ed. P. 320 or 330 or equiv. Elements of experimental design and their implications for (including computer graphs) setting up research, sampling methods, recording and display of data, interpretation of data, design and analysis of experiments over time, trend analysis statistics appropriate to individual and group designs.
330. *Foundations of Educational Measurement*. I, II, S. 3 hr. An examination and application of norm referenced and criterion referenced principles and procedures to the measurement and prediction of pupil performance.
333. *Nonparametric Statistics*. II. 3 hr. PR: Introductory course in statistics. Single sample tests; for related samples, two independent samples, K related samples, K independent samples, and measures of correlation.
341. *Multivariate Methods 1*. I. 3 hr. PR: Stat. 311. Elementary matrix operations, partial and multiple linear and non-linear correlation and regression analysis, and introduction to discriminant analysis.
342. *Multivariate Methods 2*. II. 3 hr. PR: Stat. 341 or equiv. The multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs.
343. *Statistical Analysis in Education*. I, II, S. 3 hr. PR: Ed. P. 330 or consent. Review measures of central tendency, percentiles, and correlation. Emphasis placed on correlation, regression, testing hypothesis, non-parametric tests, and other measures in analysis and inference.
350. *Principles of Behavior Modification*. I, II, S. 3 hr. Application of reinforcement theory as an instructional technique in changing human behavior. Analysis of problems in terms of behavior and the design of instruction and treatment programs to produce desired change.
360. *Instructional Systems 1*. I. 3 hr. PR: Ed. P. 260 or consent. Delineate topic and concepts; describe target population; develop behavioral objectives; weight objectives; develop test pool; establish performance levels, produce scripts; and produce instructional materials.
361. *Instructional Systems 2*. II. 3 hr. PR: Ed. P. 350, 360, or consent. Design of a total instructional systems to teach a set of specified objectives to a specific target population of learners, including production questions, and quality control.
362. *Instructional Systems — Administration and Management*. II, S. 3 hr. PR: Ed. P. 361 or consent. The conduct of instructional operations within instructional systems; the administration and management of organizational arrangements to support system approaches to instruction.

363. *Communication Theory for Instructional Systems*. I. 3 hr. PR: Graduate standing. Psychological foundations of the communications process in instructional systems.
385. *Practicum*. I, II, S. 1-12 hr. PR: Consent.
391. *Problem in Educational Psychology*. I, II, S. 3 hr. PR: Consent.
420. *Advanced Educational Research*. I, II, S. 3 hr. PR: Sat. 311 and consent. Identification of research problems in education, consideration of alternative designs and methods of investigations, and development of a research proposal at the advanced graduate level.
440. *Human Development and Behavior*. I, II, S. 3 hr. Psychological theories of human development. Contemporary theories analyzed and compared with emphasis on their implication for classroom behavior and the educational process.
450. *Psychological Foundations of Learning*. I, II, S. 3 hr. Psychological and philosophical foundations of major learning theories and their implications for instructional procedures.
451. *Principles of Instruction*. I, II, S. 3 hr. PR: Consent. Basic principles of teaching-learning process implied in major learning theories; study of factors in learning, variables in instructional program, and principles of instructional design.
452. *Stimulus Conditions in Learning*. II. 3 hr. Stimulus conditions and stimulus control in human association learning, discrimination learning, sequence learning, concept learning, and problem solving.
480. *Seminar*. I, II, S. 1-6 hr. PR: Consent.
481. *Special Topics*. I, II, S. 1-6 hr. PR: Consent.
490. *Teaching Practicum*. I, II. 1-3 hr. PR: Consent. Intended for graduate students with college teaching responsibility. Provides a supervised experience for graduate students in a teaching situation.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced areas of educational psychology.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. Designed to permit graduate student an opportunity to present research to the assembled faculty and graduate student body.
497. *Research*. I, II, S. 1-15 hr. PR: Consent. Dissertation.
498. *Thesis*. I, II, S. 2-4 hr. PR: Consent.

ELECTRICAL ENGINEERING

Ronald L. Klein, *Chairperson of the Department*

823 Engineering Sciences Building

Degrees Offered: M.S.E.E., M.S.E., Ph.D.

Graduate Faculty: Members Aldridge, Balanis, Cannon, Cooley, Klein, Mikhael, Smith, and Swartwout. Associate Members Barbe, Corum, Dubbe, Jerabek, McConnell, and Nutter.

The Department of Electrical Engineering, with 20 faculty members, 400 undergraduate students, and over 40 graduate students offers excellent graduate training in:

1. Electric power systems including stability, transients, real time control, protection, and steady state analysis.
2. Electromagnetics including antennas and microwave systems and radar.

3. Digital systems design including microprocessors, advanced computer architecture, digital filtering, and digital signal processing.

4. Electronics and solid state circuits including circuit analysis, integrated circuit design, and both digital and analog systems design.

Approximately ten M.S.E.E. and three Ph.D. degrees are awarded each year and graduates from these programs are in great demand by industry. It is particularly noteworthy that the graduate curriculum in power systems has recently been added to the list of programs approved for American Electric Power System Fellows.

Electrical power systems historically has been an area of emphasis in the electrical engineering curriculum, and the graduate program in power systems at WVU is quite mature. Five graduate courses are offered in this area on a regular basis. In addition, there are four senior elective/graduate courses on such subjects as distribution, industrial power systems, power electronics, and advanced power systems analysis. Outside research funding for work on reliability, grounding, transmission, electric transportation, and optimal design provides excellent support for both graduate students and faculty research. Extensive cooperation with industry also provides ample opportunity for field study.

Electromagnetics in general encompasses the generation, radiation, propagation, scattering, interaction with matter, and reception of electromagnetic energy from radio to optical frequencies. The electromagnetics faculty has strong credentials for, and interest in, theoretical, experimental, and numerical techniques. The department offers senior/graduate courses in antennas, microwaves, and radar each academic year. In addition, graduate level courses in advanced electromagnetics, wave propagation, relativistic field theory, antenna theory, and guided waves are offered on a regular basis. Research projects, most of which have been funded by sponsors outside the University, have been conducted in the following areas: Fourier transform inversion methods, geometrical theory of diffraction, numerical techniques, electromagnetic wave propagation, electrical properties of coal at radio frequencies, tomographical reconstruction methods, electromagnetic instrumentation for coal-related applications, microwave communication analysis (terrestrial and satellite), relativistic rotational electrodynamics, and new solutions to the Einstein-Maxwell field equations.

Digital computer and microprocessor systems design is the most technology intensive component in the electrical engineering curriculum. Integrated circuits with increasing capabilities are rapidly being developed. In turn, the demand for electrical engineers with strong educational backgrounds in these areas is rising very rapidly. The electrical engineering curriculum offers a large selection of both required and elective graduate courses in computer systems. These cover such topics as digital logic, microprocessor applications, interfacing, computer architecture, computer arithmetic, and advanced courses in switching circuit theory. In addition, the department cooperates closely with the University's Computer Science faculty so that electrical engineering graduate students are able to take computer science courses in real-time operating systems, data structures, and digital communications software, as well as computer hardware courses taught in the department. A number of research projects utilizing computers and/or design of computer systems has been completed or are being performed by the faculty and students of the department. Some examples are real-time monitoring of environmental conditions in a coal mine using digital communications and a minicomputer, a distributed microprocessor monitoring system, and a study of the methodology whereby the reliability of an environmental monitoring system can be established.

Electrical communications have made dramatic impacts on human life. The department offers courses in the basics of communications as well as more contemporary new developments, such as digital communications, digital signal processing, pulse code modulation, frequency shift keying, and spread spectrum systems. Examples of research projects in communications engineering that are being conducted by faculty and graduate students are: development of an improved communication system for an urban transportation system, basic research in adaptive noise cancelling circuits, electronically programmable active filters, and the use of spread spectrum techniques.

The Department of Electrical Engineering is authorized to admit students to the degree programs of the Master of Science in Electrical Engineering (M.S.E.E.) and the Master of Science in Engineering (M.S.E.) It also participates in the College of Engineering interdisciplinary Ph.D. degree program. Graduate students in the Department of Electrical Engineering must comply with the rules of the Graduate School and with the requirements specified in "A Guide to the Graduate Program in Engineering." Students should also refer to Part 3 of the *Graduate School Catalog* for a general description of the graduate programs in engineering.

Master of Science in Electrical Engineering (M.S.E.E.)

Master of Science in Engineering (M.S.E.)

Course Requirements. All M.S. degree candidates will be required to meet the following minimum requirements:

1. At least two courses selected from the following: E.E. 315, 325, 333, 340, 350 or 357, 364, and 370 — 6 hr. (min.).
2. Selected courses offered outside the Department of Electrical Engineering to provide analytical techniques supporting the student's graduate program. (For example: Mathematics, Physics, Computer Science, etc.) — 6 hr. (min.).

Each M.S. degree candidate will be required to make an oral presentation of the thesis or problem research to a graduate seminar which will be given near the conclusion of the student's research but before scheduling the final examination.

Entrance Interview. All students beginning graduate study in electrical engineering will be given an entrance interview. The interview determines if a student is adequately prepared to pursue a graduate degree program and aids the faculty in advising the student. As a result of the interview, the student and the committee should prepare a mutually acceptable preliminary plan of study.

Students with deficiencies in their undergraduate program may be required to take some engineering or other courses as prerequisites for graduate courses. These deficiencies are usually noted as a condition for admission. However, they may also be specified as a result of the entrance interview.

Thesis. Normally a thesis is required of all M.S. candidates in electrical engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and should conform to additional thesis requirements of the department.

Final Examination. Each candidate for the M.S. degree shall pass a final examination administered by the student's Advisory and Examining Committee. This examination may be written or oral, or both, and shall cover the course materials and defense of the thesis or report when applicable.

Students may be admitted to the M.S.E.E. program if they hold a baccalaureate degree in electrical engineering or its equivalent. Students who lack this requirement may either make up the necessary undergraduate course work or may apply for admission to the M.S.E. program with emphasis in electrical engineering.

The M.S.E. program is available to students who are interested in graduate work in electrical engineering but who hold a baccalaureate degree from another field of engineering or from another discipline. Students with a baccalaureate degree from another field of engineering or from one of the sciences should contact the Department of Electrical Engineering for further information. In general, a student in the M.S.E. program will not be asked to complete all of the requirements equivalent to the B.S.E.E. degree. However, all graduate students will be required to meet the prerequisites for each course taken for credit.

Doctor of Philosophy

Students interested in electrical engineering and who wish to pursue the Ph.D. degree should contact the department for information about the interdisciplinary Ph.D. program in engineering. While it is possible for a student with only a B.S. degree to enroll directly in the Ph.D. program, it is usually advisable for the student to earn an M.S. degree first. Students in the Ph.D. program must comply with the rules and regulations outlined in the general requirements for graduate work in engineering and the interdisciplinary Ph.D. degree as stated in "A Guide to the Graduate Program in Engineering."

A typical Ph.D. program will take between three and four years beyond the baccalaureate degree. The courses chosen for a given student's program are selected to accomplish three objectives: (1) to develop the student's expertise in his/her area of interest, (2) to strengthen knowledge of other areas that will support the student's research endeavors, and (3) to satisfy the Interdisciplinary curriculum requirements of the College. A possible outline for a Ph.D. program:

First Year — M.S. degree

Second Year —

- (a) An approved plan of study consisting mainly of courses in the 300 and 400 series.
- (b) Admission to candidacy for the Ph.D. degree
 - (1) Pass written and oral comprehensive examinations
 - (2) Successfully defend research proposal
 - (3) Complete all program requirements set by the student's advisory and examining committee.

Third Year —

- (a) Complete research and write dissertation
- (b) Defend dissertation in final examination

Research work for the doctoral dissertation is expected to represent a significant contribution to engineering. It may entail a fundamental investigation into a specialized area or a broad and comprehensive system analysis or design.

Electrical Engineering (E.E.)

200. Seminar. (Credit). PR: Senior standing. Special materials and projects.

- 201 * *Electronics for Scientists*. 3 hr. PR: General physics and elementary calculus or consent. Special course for chemists, physicists, medical researchers, and other research workers having a limited background in electronics. Electrical and electronic fundamentals. Application of electronic instrumentation and electrical signal processing. (Not normally open to Engineering students.) 2 hr. rec., 3 hr. lab.
208. *Power Electronics*. 3 hr. PR: E.E. 130 and E.E. 130 and E.E. 154 (concurrently) or consent. Application of power semiconductor components and devices to power systems problems: power control, conditioning processing, and switching. Course supplemented by laboratory problems. 3 hr. rec.
216. *Fundamentals of Control Systems*. 3 hr. PR: E.E. 125. Fundamental concepts of feedback control system analysis; stability, and design in the frequency, complex variable, and time domains. Includes Nyquist, root locus and state variable concepts. Mitrovic's method and Chen's method. 3 hr. rec.
- 218.* *Engineering Analysis and Design*. 3 hr. PR: E.E. 130, 154, 200. Application of the method of engineering analysis based upon fundamental physical laws, mathematics, and practical engineering consideration. Emphasis on the professional approach to analysis of engineering problems. 3 hr. rec.
230. *Electrical Power Distribution Systems*. 3 hr. PR: E.E. 131 or consent. General considerations; load characteristics; subtransmission and distribution substations; primary and secondary distribution; secondary network systems; distribution transformers; voltage regulation and application of capacitors; voltage fluctuations; protective device coordination. 3 hr. rec.
231. *Electrical Power Systems I*. 3 hr. PR: E.E. 131 or consent. Analytical methods for steady-state performance of power systems. 3 hr. rec.
234. *Power System Stability*. 3 hr. PR: E.E. 231 or consent. Transient stability, acceleration equations, stability criteria. Two machine and multi-machine problem, solutions by digital analysis. Methods of improving stability. 3 hr. rec.
244. *Introduction to Antennas and Radiating Systems*. 3 hr. PR: E.E. 141 or consent. Radiation from current distributions, linear antennas, far field approximations, field equivalence theorems, aperture antennas, antenna arrays, patterns, and gain, and application to specific antenna types. 3 hr. rec.
245. *Microwave Circuits and Devices*. 3 hr. PR: E.E. 141. UHF transmission line theory, impedance matching techniques and charts, general circuit theory of one port and multiports for waveguiding systems, impedance and scattering matrices, waveguide circuit elements, microwave energy sources. Course will be supplemented by laboratory problems. 3 hr. rec.
246. *Radar and RF Systems Engineering*. II. 3 hr. PR: E.E. 126, 141, 152. An introduction to radar system fundamentals and techniques, including a discussion of modulation and detection theory, mixers, antennas, and propagation effects. Application of probability and statistics to signal processing and detection in noise and clutter. 3 hr. rec.
252. *Electronics III*. 3 hr. PR: E.E. 154. Linear integrated circuit building blocks applied to such functions as amplification, controlled frequency response, analog-digital conversion, sampling, and waveform generation. 2 hr. rec., 3 hr. lab.
253. *Physical Electronics I*. 3 hr. PR: E.E. 150 or equiv. Properties of semiconductors and electrical conduction processes in solids. Applications of these principles in determining the characteristics of discrete electronic devices. Introduction to lasers and masers. 3 hr. rec.

*Courses indicated will not usually apply for credit toward a graduate degree in Electrical Engineering.

257. *Transistor Circuits*. 3 hr. PR: E.E. 152 or equiv. Analysis and design of multistage transistor amplifiers. Methods of handling the interaction between stages. Gain and bandwidth of multistage low-pass and tuned amplifiers. Feedback amplifiers. 3 hr. rec.
264. *Introduction to Communication Systems*. 3 hr. PR: E.E. 126. Introduction to the first principles of communication system design. Analysis and comparison of standard analog and pulse modulation techniques relative to band-width, noise, threshold, and hardware constraints. Communication systems are treated as opposed to individual circuits and components of the system. 3 hr. rec.
271. *Logic of Digital Computers*. 3 hr. PR: Consent. An introduction to the design of digital networks and computers. Topics include: computer organization, number systems and representations, Boolean or switching algebra, logic design, minimization of logic, sequential networks and the design of digital subsystems. 3 hr. rec.
272. *Introduction to Computer Hardware Architecture*. 3 hr. PR: Consent. Introduction to basic digital systems and computer architecture. Definition of information storage concepts, central processor designs, and input/output concepts. Content addressable memories, microprogrammed control, addressing techniques, interrupts, and cycle stealing. 3 hr. rec.
274. *Introduction to Microprocessor Based Design*. 3 hr. PR: E.E. 271 or consent. Microprocessor terminology and system design. A systems approach is taken to individual student designs of microprocessor systems. A "hands-on" electronic development approach is taken using state-of-the-art computer technology. 3 hr. rec.
275. *Pulse Techniques*. 3 hr. PR: E.E. 152. Introduction to the response of electrical networks to non-sinusoidal inputs, analysis of active networks with large signals and circuits and techniques used in pulse and digital equipment. Student use the University's computing facilities by solving problems using ECAP. No previous programming is needed. 2 hr. rec., 3 hr. lab.
278. *Analogue Computers*. 3 hr. PR: Math. 18. Theory and operation of analogue computers. Amplitude scaling and time scaling on the computer and application of computer to solution of differential equations. 3 hr. rec.
280. *Electrical Problems I*. 1-3 hr. For junior, senior, and graduate students.
312. *Feedback System Theory*. 3 hr. PR: E.E. 216, 325. Signal flow graphs; sensitivity; return difference; mathematical definition of feedback; effects of feedback; multiple loop systems; multivariate systems. 3 hr. rec.
315. *State Variable Analysis of Systems*. 3 hr. PR: Consent. Matrix theory and linear transformations as applied to linear control systems. The state-space or time-domain study of stability, controllability, observability, etc. 3 hr. rec.
316. *Synthesis of Feedback Systems I*. 3 hr. PR: E.E. 312, 364. Methods of direct synthesis and optimization of feedback systems; Wiener theory; Pontryagin's maximum principle; dynamic programming; adaptive feedback systems. 3 hr. rec.
325. *Advanced Linear Circuit Analysis*. 3 hr. PR: Consent. Systematic formulation of circuit equations. Use of operational techniques to find total solutions. Applications and characteristics of the Laplace and Fourier transforms, matrix algebra, complex variable theory and state variables are made to circuit analysis and elementary circuit synthesis. 3 hr. rec.
328. *Modern Network Synthesis*. 3 hr. PR: E.E. 325 or consent. Two-terminal network synthesis; Brune and Bott-Duffin synthesis; four-terminal networks; modern filter synthesis; Darlington synthesis, transfer-function synthesis; ladder and lattice synthesis; potential analogy and approximation problems. 3 hr. rec.

330. *Advanced Electrical Machinery*. 3 hr. PR: E.E. 131 or consent. Theory and modeling of synchronous, induction, and dc machines, and their steady-state and transient analysis. 3 hr. rec.
331. *Electrical Power Systems II*. 3 hr. PR: E.E. 231 or consent. Electrical transients on power systems including traveling waves due to lighting and switching. Principles of lighting protection. 3 hr. rec.
333. *Application of Digital Computers to Power System Analysis*. 3 hr. PR: E.E. 231 or consent. Incidence and network matrices; algorithms for their formation; three-phase networks; short-circuit calculations; load-flow studies. 3 hr. rec.
340. *Electromagnetic Fields and Guided Waves I*. 3 hr. PR: E.E. 141 or equiv. Plane waves in dielectrics, conducting, and anisotropic media; polarization, radiation; duality; image theory; equivalence principle; Green's functions; integral equations; plane wave functions. 3 hr. rec.
344. *Advanced Antenna Theory*. 3 hr. PR: E.E. 244 or equiv. Slot horn, reflector, and broadband antennas; coupling between elements; aperture synthesis; adaptive arrays; applications of Fourier transform methods, high-frequency asymptotic techniques (GTD), moment method, and tensor Green's functions to antenna theory. 3 hr. rec.
350. *Electronic Circuits*. 3 hr. PR: E.E. 154 or equiv. Analysis and design of electronic circuits; low-pass and band-pass amplifiers, single-tuned and double-tuned stages, equal ripple and maximally flat responses. 3 hr. rec.
353. *Physical Electronics II*. 3 hr. PR: E.E. 154 or equiv. Semiconductor surfaces; surface states, space charge and the field effect. 3 hr. rec.
357. *Linear Integrated Circuits*. 3 hr. PR: E.E. 154 or equiv. Techniques of integrated circuit design and fabrication. Development of models descriptive of linear and non-linear transistor operation. Design and analysis of high-frequency tuned, dc, and differential amplifiers. Primarily for students specializing in communication and electronics. 3 hr. rec.
358. *Integrated Logic Circuits*. 3 hr. PR: E.E. 154 or equiv. or consent. Techniques of integrated circuit design and fabrication. Development of transistor model for nonlinear operation. Design, analysis, and comparison of emitter-coupled, direct-coupled, diode-transistor, and transistor-transistor integrated logic circuits. Intended for students specializing in digital circuits. 3 hr. rec.
364. *Communication Theory*. 3 hr. PR: E.E. 264 or consent. Detailed study of probability theory and its use in describing random variables and stochastic processes. Emphasis on applications to problems in communication system design. 3 hr. rec.
366. *Information Theory I*. 3 hr. PR: E.E. 364. Probability concepts; theory of discrete systems; encoding; theory of continuous systems; systems with memory; the fundamental theorem of information theory. 3 hr. rec.
370. *Switching Circuit Theory I*. 3 hr. PR: E.E. 271 or equiv. The course presumes an understanding of the elements of Boolean or switching algebra. A study of both combinational and sequential switching circuits with emphasis on sequential networks. Advanced manual design and computer-aided-design techniques for single and multiple output combinational circuits are covered initially. Analysis and design of sequential circuits. Detection and prevention of undesired transient outputs. 3 hr. rec.
372. *Advanced Computer Architecture*. 3 hr. PR: E.E. 271 and 272 or consent. Formal tools for designing large digital systems are introduced; formal descriptive algebras such as ISP, PMS, AHPL, CDL, and others. An in-depth study of computer system designs including instruction design and data path design is given. 3 hr. rec.

373. *Design of Computer Arithmetic Circuits I*. 3 hr. PR: E.E. 271 or equiv. Detailed study of computer circuitry usable in performing binary arithmetic. Logic, circuitry, and engineering aspects of digital computer equipment design. Primary emphasis on design of high speed, parallel arithmetic units using the natural binary number system. Analysis of systems for representing negative numbers. Study of various means for obtaining high speed addition, subtraction, and multiplication. 3 hr. rec.
374. *Design of Computer Arithmetic Circuits II*. 3 hr. PR: E.E. 373. Continuation of E.E. 373. High speed binary division, floating point arithmetic, modular or residue arithmetic, and techniques for checking arithmetic are covered. Recent innovations studied as literature becomes available. 3 hr. rec.
380. *Electrical Problems II*. 1-6 hr. For graduate students.
390. *Advanced Independent Study*. 1-6 hr. PR: Consent. Individual investigation in advanced electrical engineering subjects not covered in formal courses.
400. *Seminar*. 0-3 hr. PR: Consent.
411. *Nonlinear Control System Analysis*. PR: Consent. Application of Liapunov's and Popov's methods to nonlinear control systems, together with classical techniques. 3 hr. rec.
413. *Sample-Data Control Systems*. 3 hr. PR: E.E. 312 or consent. A study of control systems in which the activating signal is represented by samples at regular time intervals. 3 hr. rec.
416. *Synthesis of Feedback Systems II*. 3 hr. Continuation of E.E. 316. 3 hr. rec.
430. *Real-Time Control of Electrical Power Systems*. 3 hr. PR: E.E. 231 or consent. Application of computers to modern control theory for reliable and economic real-time operation of integrated power systems. 3 hr. rec.
432. *Protection of Power Systems*. 3 hr. PR: E.E. 231 or consent. Principles of relay protection for faults on transmission lines and other devices. Use of overcurrent, differential distance, and pilot relaying systems. Special relay applications. Determination of short-circuit currents and voltages from system studies. 3 hr. rec.
440. *Electromagnetic Fields and Guided Waves II*. 3 hr. PR: E.E. 340 or equiv. General theory of waveguides, cavity resonators, modes, losses, discontinuities, power considerations, scattering, perturbational and variational techniques. 3 hr. rec.
466. *Informational Theory II*. 3 hr. Continuation of E.E. 366. 3 hr. rec.
471. *Switching Circuit Theory II*. 3 hr. PR: E.E. 370, Math. 236, or equiv. Switching circuit theory is used to model the operations of networks of logic gates and flip-flops. Networks of this type are one form of discrete parameter systems. Studies the use of linear sequential machine as a means of modeling the general class of discrete parameter information systems. Systems approach and the techniques of abstract algebra used throughout. 3 hr. rec.
472. *Digital Systems Design II*. (Offered alternate years.) 3 hr. PR: E.E. 372 or consent. Students will design a specific digital system, i.e. CPU control, interrupt structure, memory, or input/output system. They will design and test a project oriented toward one specific objective.
491. *Advanced Study*. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Graduate Seminar*. 1 hr. PR: Consent. Technical presentations by faculty members, outside speakers and graduate students. Each student will give an oral presentation describing the student's research before the student's final examination. This will typically be a 40-minute presentation before the faculty and graduate students.

(See Eng. 260 under General Engineering in Part 5.)

ELEMENTARY EDUCATION

Paul R. McGhee, Chairperson of the Department of Curriculum and Instruction
602 Allen Hall

Degrees Offered: M.A. in Elementary Education; M.A. in Secondary Education; Ed.D.

Graduate Faculty: Members Bower, Carline, Carlton, Couch, DeVore, Douglas, Elkins, England, Erickson, Fairbanks, Fehl, Hatcher, Helfeldt, Holtan, Horacek, Iannone, Kelly, Kurucz, Lawrence, Love, O. C. McGhee, P. R. McGhee, Marcum, Moxley, Murphy, Murray, Obenauf, Parker, Phillips, Plants, Redick, Ribovich, Saltz, Sears, D. W. Sunal, Wales, Yeazell, and Yost. Associate Members Deay, DePue, Eisele, Hobbs, McCrory, Marsicano, Pytlik, Smith, Solomon, C. C. Sunal, Venable, and Wilhelm.

The Department of Curriculum and Instruction of the College of Human Resources and Education offers a Master of Arts program for teachers and other personnel who work with young children. The purpose of the program is to prepare master teachers who work with children from nursery through elementary school. The program provides the opportunity to specialize in early childhood, middle childhood, or a subject area. With adviser approval, electives may be selected that enhance the students' personal goals. While teacher certification is not a part of the master's program, through careful planning, students may be able to complete some courses that are required for certification while working on a graduate degree.

Master of Arts in Elementary Education

(For students who wish to work with young children, a concentration of course work in early childhood education may be arranged.)

All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Curriculum and Instruction.

I.	Required Courses	Program	Hours		
			A	B	C
	C&I 301		3	3	3
	C&I 330		3	3	3
	C&I 340		3	3	3
	C&I 350		3	3	3
	C&I 391		0	3	0
	C&I 497		6	0	0
	Ed. F. 320 or 340		3	3	3
	Ed. P. 330		3	3	3
	Ed. P. 320		3	3	0
	Rdng. 321		3	3	3
	Total Required Courses		30	27	21
	General Education Electives		0	3	15
	(All courses must be approved by the adviser before enrollment)				
	Total for Masters Degree		30	30	30
	Program A — Thesis required.				
	Program B — Research problem required.				
	Program C — 36-semester hour course work program.				

Master of Arts

Emphasis: Early Childhood Education

I.	Required Courses	Program	Hours		
			A	B	C
	C&I 312		3	3	3
	C&I 314		3	3	3
	C&I 316		3	3	3
	C&I 391		0	3	0
	C&I 497		6	0	0
	Rdng. 323		3	3	3
	CDFR 341		3	3	3
	Ed. P. 330		3	0	0
	Total Required Courses		24	18	15
II.	Approved Electives				
	Restricted Electives		0	6	9
	Supportive Electives		0	0	6
	Open Electives		6	6	6
	Total for Master's Degree		30	30	36

Program A — Thesis required.

Program B — Research problem required.

Program C — 36-semester hour program for classroom teacher.

Curriculum and Instruction (C&I)

205. *The Junior High School*. I, II, S. 2 hr. PR: Consent. Developing philosophy, program, and practices of the junior high school.
210. *Early Childhood Education*. I, II, S. 3 hr. PR: CDFR 142, Ed. P. 106. Introduction to methods and materials in early childhood education for curriculum, instruction and program organization, development, and evaluation. The content of this course is applicable to field placement in a preschool, nursery school, day care, and/or child development center. A field experience with children 3-5 years of age is required.
211. *Early Childhood Education*. I, II, S. 3 hr. PR: CDFR 142, Ed. P. 106. This course is designed for individuals who will be working within early childhood programs for children under 8 years of age. The various aspects of early childhood education are studied in relationship to organizational and administrative structures. This includes planning, budgeting, staffing, supervising, and evaluating comprehensive learning facilities for young children. A field of experience with children 3-5 years of age is required.
224. *Approaches to Teaching Language*. II. 2 hr. PR: Lingu. 1 and Engl. 111. Designed for prospective teachers of English and language arts. Focus is upon planning and implementing methods of teaching English as a language. Materials and resources appropriate to public school instruction are analyzed and utilized.
225. *Approaches to Teaching Literature*. II. 2 hr. PR: Junior standing. Designed for prospective teachers of English and language arts. Course focuses upon methodologies for teaching literature in public schools. Workshop format will provide opportunities for peer teaching activities as students apply methods of teaching literature.
279. *Organization Administration of Physical Education*. 3 hr. (Also listed as P.E. 192.)
280. *Special Problems and Workshops*. I, II, S. 1-4 hr. PR: 14 hr. in education. To take care of credits for special workshops and short intensive unit courses on methods,

supervision, and other special topics. Maximum of 8 semester hours may be applied toward the master's degree.

287. *Advanced Clinical Experience*. I, II, S. 1-6 hr. PR: Consent. Clinical experience in teaching-learning situations at any level.
301. *The Elementary-School Curriculum*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Analysis of curriculum designs in elementary education with emphasis on methods and techniques of development.
306. *Curriculum for Middle Childhood*. I, S. 3 hr. Survey course which includes: historical, social and cultural influences on the curriculum; the learner characteristics; curriculum and instructional organization and their relationship to facilities available; evaluation and implementation of middle childhood curriculum.
307. *Curriculum Development*. I, II, S. 3 hr. PR: C&I 301 or C&I 304 or C&I 312 and Ed.F. 320 or consent. Basic foundation in the concepts underlying the school curriculum in American society.
308. *Introduction to Alternative Learning Environments*. I. (Alternate Years.) 3 hr. This course will provide opportunities for educators to explore and analyze the trends and issues in alternative learning environments in public education.
309. *Experiences in Alternative Learning Environments*. S. (Alternate Years.) 6 hr. PR: C&I 308, Ed. F. 320, consent. This course helps teachers to learn and practice the skills that are needed to be an effective teacher in an alternative teaching environment.
312. *Early Childhood Curriculum*. I. 3 hr. PR: C&I 210, 211, consent. Historical, theoretical perspectives in curriculum development for early childhood education including social, creative, cognitive, and physical goals.
314. *Early Childhood Instruction*. II. 3 hr. PR: C&I 312 and consent. Design of instruction for individualization and development of mastery in curriculum goals for early childhood.
316. *Early Childhood Program Development and Evaluation*. I. 3 hr. PR: C&I 312, 314 and consent. Development and evaluation of facilities, programs, and support systems for early childhood education.
317. *Language Skills in Early Childhood*. S. 3 hr. PR: Consent. An examination of language skills and the sequence in which they are learned in early childhood with special attention to the environment of instructional influences which could contribute to their acquisition. (Offered in alternate summers.)
319. *Behavior Modification: Early Childhood Education*. S. 3 hr. PR: Consent. Application of behavior modification to early childhood education with special attention to an examination of the methods and values involved. (Offered in alternate summers.)
330. *Mathematics in the Elementary School*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education or consent. Materials and methods of instruction for modern mathematics programs.
333. *Corrective Techniques in Mathematics Education*. I, S. 3 hr. PR: Consent. Materials and methods used in diagnosis and remediation of learning difficulties in mathematics.
337. *Mathematics in the Junior High School and Middle School*. II. 3 hr. PR: 6 hr. college mathematics or consent. Study of teaching of mathematics in the junior high school and/or middle school; application of mathematics content to teaching; instructional techniques and materials.
340. *Science in the Elementary School*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Analysis of methods, curriculum patterns, and trends in elementary school science. Understanding and development of scientific attitudes appropriate at elementary school level.

350. *Social Studies in the Elementary School*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Comprehensive consideration of objectives, content, methods, including unit procedures; materials including objects, models, exhibits, and museum items, as well as textbooks, collateral reading, maps, and graphs; means of evaluating social growth and development.
357. *Principles of Economic Education*. S. 3 hr. Workshop for principals, teachers, and supervisors with emphasis on the economic structure of our society and methods of integrating economics into the school program. (Sponsored jointly by College of Human Resources and Education and College of Business and Economics.)
359. *Classroom Simulation Techniques*. II, S. (Alternate Years.) 3 hr. To provide experience in the use of learning games and simulations as an instructional technique and the opportunity to develop — under supervision — simulated activities and games to be used in a variety of learning environments.
373. *Professional Development*. I, II, S. 1-6 hr. (May be repeated.) PR: Department approval. Specially designed experiences for those interested in advancing professional skills in a particular specialty. Not for degree credit in programs in the College of Human Resources and Education. (Graded as S/U.)
377. *Children's Television: Problems and Potentials*. S. 4 hr. PR: Consent. Provides parents and teachers with strategies for monitoring, evaluating, and directing television viewing habits of youth; pertinent research studies, school and community action programs, and home and school education programs are discussed and practiced.
380. *Special Topics*. I, II, S. 1-6 hr. PR: Consent.
383. *Seminar*. I, II, S. 1-6 hr. PR: Consent.
385. *Supervision of Student Teachers*. I, II, S. 3 hr. PR: Consent. For persons working or intending to work with education students in field experiences. Course focuses on the development and application of supervisory skills involved in effective guidance of student teachers and education students.
386. *Teaching Strategies for Middle Childhood*. II, S. 3 hr. Surveys instructional strategies appropriate for facilitating preadolescent learning. Includes the role of the teacher, how the teacher uses resources within and outside the classroom as they relate to instruction of the learner age 10-14 years.
391. *Problem in Education*. I, II, S. 3 hr. Research for master's degree in education, option B.
395. *Practicum*. I, II, S. 1-12 hr. per sem. or session — aggregating not more than 12 hr. PR: 9 graduate hr. in education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences or problems and projects in education.
407. *Instructional Models of Teaching*. II. 3 hr. PR: Ed. F. 320 or consent. Concepts and processes involved in teaching and their relationship to the development of teacher education programs.
408. *Contemporary Determinants of Curriculum*. II, S. 3 hr. PR: C&I 307 and Ed. F. 340 or consent. Contemporary determinants of curriculum development.
409. *Curriculum Theories*. I, II, S. 3 hr. PR: C&I 408 or consent. Theories underlying curriculum from the past to the present and projected to the future.
438. *Survey of Major Issues in Mathematics Education*. II, S. 3 hr. PR: Consent. Individual and group research on selected topics in mathematics education.

457. *Social Studies Curriculum Development, K-12. I.* 3 hr. PR: C&I 301 or 304 and C&I 350 or 354. Stresses the application of principles and procedures pertinent to the development of social studies programs in elementary and secondary schools. Strong emphasis will be placed on the analysis of current social studies curriculum materials.
490. *Teaching Practicum. I, II, S.* 1-3 hr. PR: Consent. Intended for graduate students with college teaching responsibility. Provides a supervised experience in a teaching situation. (Graded as S/U.)
491. *Advance Study Project in Education. I, II, S.* 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.
496. *Advanced Seminar. I, II.* 1 hr. PR: Consent. Opportunity for the advanced graduate student to present the student's research to faculty and/or student groups.
497. *Research. I, II, S.* 1-15 hr.
498. *Thesis. I, II, S.* 2-4 hr. PR: Consent.
499. *Colloquium in Curriculum and Instruction. I, II, S.* 1-6 hr. PR: Consent. For graduate students not seeking course work credit, but who wish to participate in academic programs.

Education Foundations (Ed. F.)

300. *Sociology of Education. I or II.* 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community. (Equiv. to Soc. & A. 232.)
320. *Philosophic Systems and Education. I, II, S.* 3 hr. Examines different systems of educational philosophies, focusing on aims, values, and criteria of education. Stresses the application of philosophic thinking to educational language, issues, methods, and subject matter.
340. *History of American Education. II, S.* 3 hr. Major forces affecting U.S. educational developments at all school levels are examined in political, social, economic and cultural context. Major historical periods include colonial, early national, pre-post civil war and late nineteenth to mid-twentieth century.
350. *Comparative Education. II.* 3 hr. PR: Graduate standing. Compares educational systems in selected foreign countries with the United States. Examines formal and informal educational influences in historical and contemporary contexts and in socio-economic, political, and philosophical perspectives.
380. *Special Problems. II.* 1-6 hr. PR: Consent.
383. *Seminar. I, II, S.* 1-6 hr. Selected topics in historical, sociological, and philosophical foundations of education. Titles to be announced each semester.
390. *Special Topics. I.* 1-6 hr. PR: Consent.
491. *Advanced Study. I.* 1-6 hr. PR: Consent.

ENDODONTICS

Arthur E. Skidmore, *Chairperson of the Department*

1067 Basic Sciences Building

Degree Offered: M.S.

Graduate Faculty: Members Alberico, Biddington, and Skidmore.

Master of Science (M.S.)

The School of Dentistry and its Department of Endodontics offer a program of advanced study and clinical training leading to the degree of Master of Science (M.S.). The program requires a minimum of 24 months (two academic years and two summer sessions) of full-time residency in the School of Dentistry and is designed to qualify dentists for careers in endodontic clinical practice, teaching, and research.

Inquiries concerning this program should be directed to the Office of the Associate Dean for Advanced Education Programs. Applicants will be processed in the School of Dentistry and will be recommended to the Graduate School for admission. Applicants approved for admission to the program will be notified soon after January 15.

Requirements for Admission to the Endodontic Program

1. Graduation from an accredited school of dentistry.
2. Evidence of scholastic and clinical achievement that would indicate the applicant's ability to progress in a program of this nature.
3. Each applicant must file with the Department of Endodontics all information requested in the departmental application form.

Requirements for Master of Science Degree

1. Fulfillment of requirements of the Graduate School.
2. Twenty-four months (two academic years and two summer sessions) of consecutive residency at the WVU School of Dentistry.
3. An approved master's thesis based on original research completed during the period of residency in an area related to endodontics.
4. Must satisfactorily pass a final oral examination.
5. Must complete a minimum of 57 credit hours. These include 32 hours of endodontic courses, a minimum of 18 hours of selected basic sciences subjects, and a thesis (7 hours).
6. Must have demonstrated satisfactory clinical competency in the student's field.
7. Must have maintained a grade level commensurate with graduate education.

Dentistry (Dent.)

400. *Advanced Oral Surgery*. I, II, S. 1-12 hr. PR: Consent. Advanced study of therapeutics, hospital protocol, and surgical aspects of oral surgery involving lectures, seminars, demonstrations, and clinical applications.

Endodontics (Dent.)

390. *Clinical Endodontics*. I, II, S. 1-5 hr. PR: Graduate of an accredited dental school and admission to the Advanced Education Program in Endodontics or consent. (May be repeated for credit.) Clinical endodontic practice in the areas of: Ordinary endodontic cases, complex endodontic cases, hemisection, root amputation, replantation, transplantation, endodontic implantation, vital pulp therapy, apexification, and bleaching.
391. *Endodontic Theory*. I, II, S. 2 hr. PR: Graduate of an accredited dental school and admission to the Advanced Education Program in Endodontics or consent. (May be repeated for credit.) Provides seminar discussions in the topics of: basic endodontic techniques, advanced endodontic techniques, endodontic literature review, case presentation, and advanced endodontic theory.

490. *Endodontic Teaching*. S. 2 hr. PR: Consent. Selected teaching experiences including lecture, clinical, and laboratory teaching of undergraduate endodontic courses.
497. *Endodontic Research*. I, II, S. 2-3 hr. PR: Consent. Students will prepare a research protocol, conduct experimental research, and prepare a thesis of original endodontic research.

Microbiology (M. Bio.)

310. *Structure and Activities of Microorganisms*. I. 2-7 hr. PR: Consent. Structure and activities of microorganisms: their structure, metabolism, nutrition, growth, and genetics. (Students can enroll for one to three parts.)
311. *Principles of Infection and Resistance*. I. 1-5 hr. PR: Consent. Introduction to the principles of innate and acquired resistance and to the mechanism of pathogenesis of medically important microorganisms. (Students can enroll for one to three parts.)

Pathology (Path.)

382. *Oral Histopathology*. (For graduate and dental students.) I, II. 1-2 hr. PR: Consent. Advanced study of the microscopic aspects of oral and paraoral disease through weekly seminars with emphasis placed on diagnosis.
401. *Special Studies in Oral Pathology*. I, II. 1-3 hr. PR: Consent. Advanced seminar or independent study of local and/or systemic disease processes affecting oral and facial structures.

Pharmacology and Toxicology (Pcol.)

360. *Pharmacology*. I. 4 hr. PR: Consent. Lecture and laboratory on pharmacologic actions and therapeutic uses of drugs.

Statistics (Stat.)

311. *Statistic Methods 1*. I, II, S. 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypothesis, confidence intervals, regressions, correlation, transformation, F and χ^2 distributions, analysis of variance, multiple range tests, missing plots, and sample size.

ENGLISH

Elaine K. Ginsberg, Chairperson of the Department of English Language and Literature
Stansbury Hall

Degrees Offered: M.A., Ph.D.

Graduate Faculty: Members Blaydes, Bordinat, Clarke, Conner, Eaton, Fitzpatrick, Foster, French, Gaskins, Ginsberg, Grant, Howard, Johnston, MacDonald, Miles, Peterson, Racin, Scafella, Stasny, Stitzel, and H. W. Ward. Associate Members Almasy, Berkley, Davis, Farkas, Fuller, Gandolfo, Madison, B. J. Ward, and Welch.

Master of Arts (M.A.)

Admission. To be admitted to the Department of English as a prospective candidate for the degree of Master of Arts (M.A.), a student is expected to have completed work comparable to the department's undergraduate requirement for English majors and to present a record distinctly above the average.

The applicant may be admitted as a *Regular Graduate Student* — one who is approved for a degree program; as a *Regular With Deficiencies* — one who is

approved but has deficiencies in one's previous work to make up; as a *Special Graduate Student* — one who is not pursuing a degree program; or as *Special Provisional* — one who because of an undergraduate record or late application cannot be immediately approved for a degree program.

Course Requirements. A candidate for the M.A. degree will be expected to complete courses covering the major periods and the works of the major authors of English and American literature. The minimum requirement is 30 hours of graduate work, 24 hours of which must be on the 300-400 course levels. English 492, Introduction to Literary Research, is required of all master's degree candidates. Two 400-level seminars are also required. Neither English 492 nor English 490, required of all teaching assistants, may be substituted for the seminar requirements.

Thesis Option. A candidate for the M.A. degree has the option of taking 30 hours of course credit, with the above requirements, or of taking 24 hours of course work and writing a thesis, for 6 hours credit, under the supervision of a thesis adviser. Information about the procedure for filing application for approval of projects, and about dates for the submission of theses, is available at the department office. The thesis may be a work of scholarship, of criticism, or of creative writing (original poetry, drama, or fiction). A candidate may register for up to 12 hours of thesis credit, but only 6 hours may be included in the 30 hours required for the degree. Thesis hours will be graded as S (Satisfactory) or U (Unsatisfactory) progress.

Examinations. A student electing to write a thesis will take a final, oral examination on a special field of interest as reflected in the thesis. All students, whether they elect the thesis option or the 30-hours' course work option, are required to take two 3-hour comprehensive written examinations in English and American literature. Each student taking these examinations will have the option, elected and approved in advance of the examination date, of having part of the comprehensive examination restructured to provide that student the option of being examined in a specialized area of expertise in literary, linguistic, or writing studies. The only question for which such a substitution may not be made is the analysis of a short poem: answering this question is required of all students taking the examinations.

The student will normally take these examinations in the semester or term following that in which the student has established acceptable credit in 24 hours of graduate course work with an average of 3.0. The examinations will be conducted not later than four weeks before the last day of classes of a semester, or three weeks before the end of a summer session. With the permission of the Examining Committee, an unsuccessful candidate may be reexamined. Success in the examinations admits the student to candidacy for a graduate degree.

Foreign Language Requirement. A candidate for the degree of Master of Arts in English must have completed studies in a foreign language equivalent to 12 semester hours of college work, with no grade lower than B. The courses may not have been taken on a pass/fail basis. The applicant who does not meet this requirement may prepare to meet it through independent study or otherwise, in order to prepare to demonstrate a reading knowledge on examination.

Doctor of Philosophy

Admission. An applicant for admission to the program will be judged on the basis of academic record, on three recommendations from former teachers, and on a personal, written statement outlining the applicant's academic and profes-

sional goals. The applicant may also submit, as an option, the results of the Graduate Record Examinations.

Provisional admission to the program may be granted to students whose credentials, while not exhibiting the high standards of prior academic achievement the department expects of doctoral candidates, promise excellence in the graduate study of English literature. Students admitted provisionally are expected to show high academic achievement during their first semester of doctoral study. All decisions on admission and status shall be made by the Graduate Admissions Committee.

Course Requirements. The doctoral program will normally require three years of full-time study beyond the master's degree or its equivalent. Thirty hours of credits in courses of the 300 and 400 series are normally required; however, exceptionally well-prepared students may be granted permission to take fewer than 30 hours of course work, upon recommendation of the Graduate Admissions Committee, in consultation with the Graduate Coordinator and the student's adviser. Of the normally required 30 hours, 12 must be taken in 400-level courses. All doctoral candidates are required to take English 492, Introduction to Literary Research, unless they have previously had an equivalent course.

No credit will be given for courses in which the grade is C or less. A student who makes C or less in more than three courses will be dropped from the program.

The writing of the doctoral dissertation will carry a value of 12 additional hours.

Preliminary Qualifying Examinations. Sometime during the student's first two years of study in the doctoral program, in order to remain in the program, the student must pass a Preliminary Qualifying Examination, a 6-hour comprehensive written examination in English and American literature. A student taking this examination will have the option to have part of the examination restructured to provide that student the option of being examined in a specialized field of scholarly competence. This is the same option available to students taking a similar examination to satisfy the requirement for the M.A. degree. Accordingly, the only question for which such a substitution may not be made is the analysis of a short poem. With the approval of the Graduate Program Committee of the department, the requirement that a doctoral student must take the Preliminary Qualifying Examination may be waived, if the student has passed the M.A. comprehensive examinations given by the department within the two years preceding the student's admission to the doctoral program. All doctoral students who have received their M.A. degrees from other English departments must take the Preliminary Qualifying Examinations.

Examinations for Formal Admission to Candidacy. During the semester in which the student completes the course work, or soon thereafter, the student may qualify for formal admission to candidacy for the Ph.D. degree by successful completion of examinations in the fields of concentration chosen from the lists below. These examinations shall be:

1. Two 3-hour written examinations drawn up from Group 1 by the adviser and the student's examination committee.
2. One of the following options:
 - a. One 3-hour written examination drawn up from Group 2 by the adviser and examination committee.
 - b. One 3-hour written examination on a major author selected by the adviser and examination committee.

Fields of Concentration. For purposes of academic convenience, fields of concentration are listed as follows. Acceptance of a candidate for specialization in a given field will depend on the staff and other resources of the Department at the time of application.

Group 1 — Periods: a. Early and Middle English Language and Literature; b. The Renaissance; c. Restoration and Eighteenth-Century Literature; d. Romanticism; e. The Victorian Era; f. The Modern Period; g. American Literature.

Group 2 — Genres, Types, and Other Fields: a. Folklore and Folk Literature; b. English Linguistics and Philology; c. English Drama; d. Prose Fiction; e. Epic and Romance; f. Lyric Poetry; g. Non-fiction Prose; h. Literary Criticism.

Teaching Requirement. After or during the completion of the course work, the doctoral student must teach successfully in the department for two semesters, one semester devoted to composition, the other to literature. Concurrent with the teaching practicum, the student must take one 400-level course in the teaching of composition and one 400-level course in the teaching of literature. This requirement will be optional for those candidates who possess teaching experience approved by the department. The student fulfilling this requirement will be designated a Teaching Fellow, an appointment equivalent to a "Part-time Instructorship" in the University.

Minor Subject. A student may complete all minor work in the Department of English, or may choose a minor, not to exceed 12 hours in 300- or 400-level courses, in a related subject offered by another department. Choice of the minor is subject to the approval of the Graduate Coordinator or a designate.

Foreign Language Requirement. The student must demonstrate proficiency in a foreign language acceptable to the Department of English. This requirement may be fulfilled either by passing a Graduate Reading Examination or by taking a minimum of two upper-division courses in the literature of the chosen language, which must be passed with a grade of A or B. Courses may not be taken on a pass/fail basis.

Doctoral Dissertation. After completing course work, passing the examinations for formal candidacy, and fulfilling the language requirement and teaching requirements, a student shall submit a prospectus of the dissertation, as specified by the department, to the adviser. On approval of the prospectus by the student's dissertation committee, the student may apply for admission to candidacy for the Ph.D. degree.

The topic of the proposed dissertation should be such that a candidate can reasonably complete the project in one year of full-time work. It is the responsibility of the dissertation committee and adviser to see that the topic is sufficiently limited.

Final Examination. When the dissertation has been accepted and approved by the candidate's adviser and the dissertation committee, the candidate will be given an oral examination by the committee. The examination will deal with the dissertation and the field it represents.

English (Engl.)

201. *Creative Writing Workshop: Fiction.* I, II. 3 hr. Advanced workshop in creative writing for students seriously engaged in writing fiction.
202. *Creative Writing Workshop: Poetry.* I, II. 3 hr. Advanced workshop in creative writing for students seriously engaged in writing a major group of poems.
208. *Scientific and Technical Writing.* I, II. 3 hr. PR: Engl. 1 and 2. Writing for scientific and technical professions. Descriptions of equipment and processes; reports and

proposals; scientific experiments; interoffice communications; articles for trade and research journals.

210. *Structure of the English Language*. I, II. 3 hr. Historical, comparative, and descriptive grammar, together with an introduction to English linguistics. (Course will not be offered in 1981-82.)
211. *History of the English Language*. I, II. 3 hr. Study of the nature of the language; questions of origins, language families, development, relationships of English as one of the Indo-European languages.
220. *American Poetry*. I, II. 3 hr. Study of major American poets of the nineteenth and twentieth centuries.
223. *Modern American Poetics*. I, II. 3 hr. A close study of those poets who have shaped the aesthetics of contemporary American poetry.
232. *Literary Criticism*. I, II. 3 hr. History of literary criticism from Aristotle to modern times.
233. *Recent Literary Criticism*. I, II. 3 hr. Brief survey of theories of major schools of modern criticism and an application of these theories to selected literary works.
234. *Modern Drama*. I, II. 3 hr. World drama from Ibsen to the present day. (Course will not be offered in 1981-82.)
235. *American Drama*. I, II. 3 hr. Representative American dramas and history of theatre in America.
236. *Tragedy*. I, II. 3 hr. Masterpieces of tragedy from Greek times to modern, with consideration of changing concepts of tragedy and of ethical and ideological values reflected in works of major tragic authors.
240. *Folk Literature*. I, II. 3 hr. The folk ballad, its origin, history, and literary significance, based on Child's collection and on American ballad collections.
241. *Folk Literature of the Southern Appalachian Region*. I, II. 3 hr. Traditional literature of southern Appalachian region, including songs, prose, tales, languages, customs, based on material collected in the region — especially in West Virginia.
245. *Studies in Appalachian Literature*. I, II, S. 3 hr. Studies of authors, genres, themes, or topics in Appalachian literature.
250. *Shakespearean Comedies and History Plays*. I, II. 3 hr. Representative comedies and histories of Shakespeare, with the background of classical and Renaissance theory and practice. (Course will not be offered in 1981-82.)
251. *Shakespearean Tragedy*. I, II. 3 hr. Principal tragedies of Shakespeare, together with the history of criticism, scholarly investigation, and interpretation.
255. *Chaucer*. I, II. 3 hr. Early poems, *Troilus and Criseyde*, and *The Canterbury Tales*. In addition to an understanding and appreciation of Chaucer's works, the student is expected to acquire an adequate knowledge of Chaucer's language.
256. *Milton*. I, II. 3 hr. All of Milton's poems and a few selected prose works.
261. *Sixteenth Century Prose and Poetry*. I, II. 3 hr. Studies from Caxton to Bacon, from Skelton to Shakespeare.
262. *Seventeenth Century Prose and Poetry*. I, II. 3 hr. Studies from Donne to Dryden. (Course will not be offered in 1981-82.)
263. *Literature of the Eighteenth Century*. I, II. 3 hr. Literature of the period 1660-1744 in relation to social, political, and religious movements of the time.
264. *Literature of the Eighteenth Century*. I, II. 3 hr. Continuation of Engl. 263, covering the latter half of the century. May be taken independently of Engl. 263.

265. *The Romantic Movement*. I, II. 3 hr. A survey of the works of the major British Romantic writers along with the introduction to works of scholarship in British Romanticism.
266. *American Romanticism*. I, II. 3 hr. Writings of Ralph Waldo Emerson, Henry David Thoreau, and Nathaniel Hawthorne. A study of relations of these men to history of their own time; their contributions to American thought and art.
267. *Victorian Poetry*. I, II. 3 hr. The major Victorian poets — Tennyson, Browning, Arnold, Rossetti, Morris, Swinburne, Fitzgerald — and a few of the later Victorian poets.
268. *Modern British Poetry*. I, II. 3 hr. British poetry from 1880 to present, including the Decadents, Counter-Decadents, Hopkins, Housman, Hardy, the Georgians, the Imagists, World War I poets, Yeats, Eliot, the Auden Group, and post-World War II poets.
280. *Southern Writers*. I, II. 3 hr. Examination of twentieth-century Southern essayists, poets, short-story writers, and novelists in relation to ideological background. *(Course will not be offered in 1981-82.)*
283. *Study of Selected Authors*. I, II. 3 hr. Study of the works of one or more major authors. *(May be repeated with a change in course content for a maximum of 9 credit hours.)*
286. *Black American Fiction*. I, II. 3 hr. Survey of novels and short stories written by black Americans from 1890 to the present. *(Course will not be offered in 1981-82.)*
288. *Women Writers in England and America*. I, II. 3 hr. Syllabus may vary from year to year to include women writers in a particular country, historical period, or genre; or writing on a particular theme.
290. *Independent Study*. I, II. 1-3 hr. PR: Departmental consent. With departmental consent, may be repeated for a maximum of 9 credit hours. Individual study of literary, linguistic, and writing problems.
293. *Practicum in Teaching Composition*. I. 1 hr. PR: Engl. 108 and 295. Designed to give prospective English and language arts teachers supervised practical experiences in individual writing tutorials.
294. *Fiction for Adolescents*. II. 3 hr. Designed for prospective teachers of English and language arts. Course focuses on recent fiction for adolescents as well as on traditional literature appropriate to the needs, interests and abilities of youth. Evaluation criteria emphasized.
- 295/391. *Approaches to Teaching Composition*. I. 3 hr. Surveys attitudes toward and techniques of teaching writing in elementary and secondary schools. Provides frequent opportunities for students to write, to analyze their writing, and to experiment in class with methods of teaching writing. *(May not be taken for both undergraduate and graduate credit.)*
310. *Old English I*. I, II. 3 hr. Study of Anglo-Saxon with selected readings from the literature of the period.
311. *Old English II*. I, II. 3 hr. PR: Engl. 310. *Beowulf* and other texts in Old English.
330. *Early English Drama*. I, II. 3 hr. Study of the medieval and early Tudor drama to the age of Shakespeare.
331. *Elizabethan Drama*. I, II. 3 hr. Study of dramas of Shakespeare's contemporaries and successors to the closing of the theatres in 1642. Includes Kyd, Marlowe, Johnson, Heywood, Chapman, Webster, Beaumont, and Fletcher. *(Course will not be offered in 1981-82.)*

332. *Restoration and Eighteenth Century Drama*. I, II. 3 hr. Comedy, tragedy, the heroic play, the drama of sensibility and the reaction against it: Etherege, Wycherley, Farquhar, Congreve, Vanbrugh, Dryden, Otway, Goldsmith, and Sheridan. (Course will not be offered in 1981-82.)
334. *Contemporary Drama*. I, II. 3 hr. Recent developments in the drama, with special attention to Miller, Williams, Sartre, Anouilh, Osborne, Pinter, Bolt, and the Absurdist. Content altered as new playwrights representing new developments come into prominence.
335. *The English Novel to the Time of Scott*. I, II. 3 hr. Study of the English novel from the sixteenth century to the time of Scott, showing the development of the novelistic art from early narrative beginnings.
336. *The English Novel, 1832-1900*. I, II. 3 hr. Continuation of Engl. 335. Development of the English novel from the early nineteenth century to the beginning of the twentieth century. (Course will not be offered in 1981-82.)
337. *The Modern Novel*. I, II. 3 hr. Twentieth-century novel, with emphasis on works of selected British novelists.
340. *The American Novel to 1915, I*. I, II. 3 hr. History of American novel, based on reading of ten or twelve novels, from the beginning to World War I.
341. *The American Novel, II*. I, II. 3 hr. History of the American novel, based on readings of ten to twelve novels from World War I to the present. (Course will not be offered in 1981-82.)
345. *Appalachian Literature*. I, II, S. 3 hr. Intensive study of selected topics, works, and writers of Appalachia.
350. *Shakespeare*. I, II. 3 hr. Intensive study of selected plays. Special attention to textual problems and to language and poetic imagery, together with the history of Shakespearean criticism and scholarship.
356. *Romantic Poetry*. I, II. 3 hr. Reading and study of the works of selected poets of the British Romantic movement with emphasis on related criticism and scholarship. (Course will not be offered in 1981-82.)
365. *Victorian Prose*. I, II. 3 hr. Study of the non-fictional writings of the great Victorian prose critics: Carlyle, Ruskin, Arnold, Newman, Macaulay, Huxley, and Morris.
366. *English Literature, 1880-1918*. I, II. 3 hr. Study of the more important writers and literary movements of the late Victorian and the Edwardian periods; emphasis on Hardy, Housman, Hopkins, Henley, Pater, Gissing, Moore, Butler, and writers of the "Aesthetic Movement."
369. *American Literature to 1830*. I, II. 3 hr. The major genres and themes of American literature in the colonial and early national periods (1620-1830) with special attention to the cultural context of the literature.
370. *American Literature, 1830-65*. I, II. 3 hr. Study of the literature of the Romantic period in American literature, concentrating on Emerson, Thoreau, Poe, Hawthorne, and Melville.
371. *American Literature, 1865-1915*. I, II. 3 hr. Study of the literature of transcendentalism, realism, and naturalism in America between the Civil War and World War I, concentrating on Whitman, Twain, James, Dickinson, Crane, Adams, and Dreiser. (Course will not be offered in 1981-82.)
372. *American Literature, 1915-Present*. I, II. 3 hr. A study of American prose, poetry, and drama since 1915.
- 391/295. *Approaches to Teaching Composition*. I. 3 hr. Surveys attitudes toward and techniques of teaching writing in elementary and secondary schools. Provides fre-

quent opportunities for students to write, to analyze their writing, and to experiment in class with methods of teaching writing. (May not be taken for both undergraduate and graduate credit.)

392. *Special Topics*. I, II, S. 1-9 hr. PR: Consent. Advanced study of special topics in language, literature, or writing.
400. *Thesis*. I, II. 3 hr.
401. *Thesis*. I, II. 3 hr.
440. *Medieval Literature*. I, II. 3 hr. Topics from English literature, 1100-1500, exclusive of Chaucer and the drama.
441. *Medieval Literature*. I, II. 3 hr. Chaucer's early poems, *Troilus and Criseyde*, and *The Canterbury Tales*.
446. *Renaissance Literature*. I, II. 3 hr. Studies devoted to a major non-dramatic writer of the period.
447. *Renaissance Literature*. I, II. 3 hr. Studies devoted to a major topic of the period.
450. *English Drama to 1642*. I, II. 3 hr.
456. *Folklore and Folk Literature. Seminar*. I, II. 3 hr. Research projects in folklore, including field work in collecting folklore in the Appalachian region and the analysis of the use of folklore in the works of British and American authors.
460. *Seminar in Eighteenth Century Studies*. I, II. 3 hr.
470. *Romanticism*. I, II. 3 hr. Studies in major authors and special topics in the field of English Romanticism.
476. *Seminar in Victorian Studies*. I, II. 3 hr. Research and discussion in selected topics in the literature and history of the period.
484. *Seminar*. I, II. 3 hr. Seminar in principal authors and movements in American literature from Colonial Period to 1870.
- 486, 487. *American Literature, 1870-*. I, II. 3 hr. Literary and intellectual America from 1870 to 1914 in terms of leading literary men and changing cultural patterns of the period. Discussion and analysis of selected prose and poetic works.
490. *Teaching Practicum*. I, II. 3-6 hr. I, Supervised practices in college teaching of expository writing. II, Supervised practices in college teaching of literature.
491. *Advanced Study*. I, II. 3 hr. Specific topics approved by the instructor.
492. *Introduction to Literary Research*. I, II. 3 hr. Bibliography; materials and tools of literary investigations; methods of research in various fields of literary history and interpretation; problem of editing. Practical guidance in the writing of theses.
493. *Folger Institute Seminar*. I, II. 3 hr. PR: Graduate standing. Seminar conducted by distinguished scholars and held at the Folger Institute of Renaissance and Eighteenth Century Studies in Washington, D.C. Topics vary. (Enrollment is by special application only. Contact department chairperson for information.) (Also listed as Hist. 493.)
494. *Seminar*. I, II. 3 hr. Specific authors to be approved by instructor.
496. *Seminar*. I, II. 1 hr. PR: Consent. Research paper to be presented orally to the faculty and students of the Department of English.
497. *Research*. I, II. 1-15 hr. PR: Consent.
498. *Doctoral Thesis*. I, II. 1-6 hr. PR: Consent.

499. *Graduate Colloquium. I, II. 1-6 hr. PR: Consent. Credit for this course may not be applied toward satisfaction of the 30-hour degree requirements at either the master's or doctoral level.*

ENTOMOLOGY

Linda Butler, Chairperson of the Program

G-166 Agricultural Sciences Building

Degree Offered: M.S.

Graduate Faculty: Member Butler. Associate Member Amrine.

Entomology is the study of insects and their arthropod relatives. Students entering the M.S. program in Entomology are expected to have an adequate background in biological and physical sciences. Additional undergraduate course work may be required to make up deficiencies or to meet the needs of the area of specialization of the student.

Thesis problems in entomology may be selected in areas of pest management; entomology of crops, forests or urban environments; apiculture; aquatic entomology; medical or veterinary entomology; acarology; araneology; or insect physiology, morphology, ecology, behavior, or systematics.

Course work and thesis research in entomology are designed to prepare students for professional careers in entomology and closely related areas of agricultural, biological, and environmental sciences. Graduates of the entomology program are employed by state and federal agencies, private industry, educational institutions or become self employed.

Facilities for graduate research include experiment farms, greenhouses, laboratories, specialized equipment and the WVU Arthropod Collection.

Entomology students seeking to pursue a Ph.D. program should enroll in the Crop Science option of Agronomy.

Entomology (Ento.)

204. *Principles of Entomology. I. 4 hr. PR: Biol. 1 and 2 or equiv. Basic course dealing with the anatomy, morphology, physiology, reproduction, systematics, ecology, and control of insects.*
210. *Insect Pests in the Agroecosystem. I. 3 hr. PR or Conc.: Ento. 204 or consent. Life cycle, damage and economic impact of pestiferous insects in the agroecosystem. Included are insect pests of agricultural and ornamental plants, stored products, structures and livestock. 2 lec., 1 lab.*
212. *Pest Management. II. 3 hr. PR: Ento. 204 or consent. An in-depth look at current problems and solutions in controlling insect pests in an environmentally compatible manner. Management techniques include cultural, mechanical, physical, biological, regulatory and chemical practices. 3 lec.*
390. *Special Topics. I, II, S. 2-6 hr. PR: Ento. 204 or equiv., or consent. Each of the following courses is given every other year: Exopterygota, Endopterygota Part I, Part II, Larval Insects, Acarology, Araneology, Pesticides in the Environment, Insect Morphology, Insect Physiology, Medical Entomology; Bee Keeping.*
450. *Seminar. I, II. 1 hr. per sem.*
497. *Research. I, II, S. 1-15 hr.*

ENVIRONMENTAL/OCCUPATIONAL HEALTH STUDIES

Ralph W. Plummer, *Coordinator of the Program*

720 Engineering Sciences Building

Degree Offered: M.S.

Graduate Faculty: Member Plummer. Associate Member Stobbe.

Master of Science (M.S.)

This program provides master-level students the opportunity to study Environmental Health, Industrial Hygiene and/or Systems Safety. This degree is designed for students who are interested in pursuing a career in occupational safety and health.

Students are admitted as regular graduate students for work leading to the Master of Science (M.S.) degree, provided they hold a baccalaureate degree from an approved institution of higher education in the areas of biology, chemistry, engineering, mathematics or physics, have a minimum 2.50 undergraduate grade-point average, and satisfy prerequisites in the courses for which they register. In order to receive the degree, the student must have a minimum 3.0 grade-point average in all course work leading to the degree and satisfy all Graduate School requirements.

Admission to candidacy for the M.S. degree is required before obtaining the degree. A graduate student may apply for admission to candidacy by formal application after completing a minimum of 12 hours of graduate courses within the program with a grade-point average of at least 3.0 based on all graduate courses taken in residence, for which the student has received a grade at the time of application. Admission must be gained before completion of 18 hours.

A minimum of 36 hours is required for the Master of Science degree.

A writing requirement is an integral part of the master's program. This requirement can be satisfied in one of three ways:

1. A no credit literature review on a suitable topic in the area of Occupational Safety and Health
2. A 3-credit-hour problem report which is based on some research
3. A 6-hour thesis

Course credit for all of the above is applicable against the 36-hour requirement.

Program of Study

Program Prerequisites

Introductory Statistics Course (Stat. 101/311, I.E. 213 or equiv.)

Chemistry (Chem. 15 and 16 or equiv.)

Fall

I.E. 260 — Human Factors Engineering*

I.E. 361 — Industrial Hygiene Engineering*

I.E. 480 — Seminar — Foundations of Occupational Safety and Health*

C.E. 245 — Properties of Air Pollutants**

Pcol. 363 — Toxicology*

*Required courses for both Industrial Hygiene and System Safety students.

**Required course for Industrial Hygiene students only.

***Required course for System Safety students only.

Spring

Env. H. 321 — Epidemiology: Principles and Practices*

Env. H. 326 — Environmental Health Sampling*

I.E. 261 — Systems Safety Engineering***

I.E. 368 — Advanced Problems in Human Factors*

Elective*

Summer

I.E. 480 — Special Topics (Noise and Ventilation Control Technology)*

Env. H. 325 — Environmental Health Analysis*

Electives

Industrial Hygiene and Systems Safety will each have a minimum of 7 elective hours.

Fall Electives

C.E. 251; Phys. 201; I.E. 214, 249, 325; M.E.M. 330; Psych. 225, 232; Manag. 216.

Environmental/Occupational Health Studies Electives

Ch.E. 290, 390, 391.

Chem. 210.

C.E. 251, 349, 350, 359, several additional 400-level courses qualify if students possess prerequisites.

I.E. 214, 249, 314, 325, 341.

Manag. 216

M.E.M. 242, 282, 330.

E.M. 201, 213, 216, 247.

Phys. 201.

Psych. 225, 232, 301.

Saf. S. 334, 336, 457.

Stat. 311, 312.

Environmental and Occupational Health Studies (Env. H.)

320. *Foundations of Environmental Health Practice*. I, II, S. 4 hr. PR: Consent. Designed to enable the environmentalist to recognize and identify environmental stresses and the effect of these stresses on man. Topics included occupational health, physical stress, safety, and basic and broad principles of toxicology.
321. *Epidemiology: Principles and Practices*. I, II, S. PR: Stat. 311 or equiv. Principles and methods of epidemiology with emphasis on descriptive and analytical epidemiological methods.
325. *Environmental Health Analysis*. I, II, S. 3 hr. PR: Consent. Intensive and comprehensive practical training in environmental health methods to include instrumentation for quantitative and qualitative detection, evaluation, and control of chemical, physical, and biological health hazards.
326. *Environmental Health Sampling*. I, II, S. 3 hr. PR: Consent. Intensive and comprehensive practical training in environmental health sampling of chemical, physical, and biological health hazards.
380. *Internship*. I, II, S. 3-6 hr. (May be repeated.) PR: Approval of committee chairperson and department chairperson. Professional internship provided on-the-job training under supervision of a previously approved environmentalist in settings appropriate to professional objectives.

FAMILY RESOURCES

Joann L. Guthrie, Chairperson of the Department
702 Allen Hall

Degrees Offered: M.S., Ed.D.

Graduate Faculty: Members M. J. Albrink, W. K. Franz, Head, Nomani, O'Palka, S. S. Redick, and Shultz. Associate Members J. L. Guthrie, N. M. MacDonald, Ramsey, D. D. Rauch, A. R. Sack, C. C. Sunal, Venjohn, Weibel, and J. I. Yeager.

Family Resources offers work leading to the degree of Master of Science.

All candidates for the graduate degree must conform to the general regulations of the Graduate School, the College of Human Resources and Education, and the Department of Family Resources.

After applying to the Graduate School, applications will be reviewed by a departmental Graduate Admissions Committee. At that time the applicant will be notified by the Chairperson of the Graduate Admissions Committee of acceptance to pursue graduate study toward candidacy for the master of science degree, according to the four types of admission described in the *Graduate School Catalog* degree program with the following exception. A student who does not have an overall undergraduate grade-point average of 2.75 may be admitted in the *special provisional* category. Reclassification will be considered upon completion of 12 hours of course work in Family Resources with a grade-point average of 3.0. Additional information may be obtained by writing the Chairperson of Family Resources.

The graduate program is designed to offer students opportunity to work in a variety of different specializations, as well as the opportunity to take graduate level course work in supporting disciplines.

The following master of science programs are offered:

1. *Home Economics Education* — A dual program is offered enabling the student to be granted a vocational certificate with the master's degree. An applicant must have graduated from an accredited institution with an earned teaching certificate. Teaching and/or work experience is strongly recommended.

2. *Child Development/Family Relations* — The particular weighting of the two areas in this program will be determined by the student's interest and need. An undergraduate major in family resources, psychology, or sociology and anthropology is recommended.

3. *Human Nutrition* — The program in human nutrition has two emphases: experimental nutrition or applied nutrition. Background in nutritional biochemistry at the undergraduate level is recommended.

4. *Homemaker Rehabilitation* — A program to prepare home economists for working with the disabled. A practicum and an internship are included in the curriculum. A bachelor's degree in home economics is required of all applicants.

Students with inadequate backgrounds will be required to take additional course work which may not apply to the master's program.

Students pursuing a master's degree in family resources will have a choice of the following three options:

1. Thirty-six semester hours, of which 6 semester hours will be thesis or internship credit. The graduate guidance committee will be consulted by the student selecting a thesis topic and in completing the thesis requirement. Approval of the thesis, following an oral examination by the graduate guidance committee of the student, will be required before the degree is granted.

2. Thirty-six semester hours, of which 3 semester hours is a written research report to be submitted to student's committee before written comprehensive examinations.

3. Thirty-six semester hours of course work completed before written comprehensive examinations (not available to Nutrition or Homemaker Rehabilitation.)

After the student has completed 12 semester hours a program graduate guidance committee will review the course work for academic performance with reference to admission to candidacy for the degree of master of science.

Additional credit hours may be required (beyond the above minimum requirements) by the graduate guidance committee if the committee determines a need for further strength in specific areas.

Approval in writing must be secured in advance from the student's committee to elect graduate courses offered at other institutions or off-campus with final approval by the Dean of the Graduate School.

Doctor of Education (Ed.D.)

The Doctor of Education (Ed.D.) is offered through the Department of Curriculum and Instruction for those interested in advanced graduate work in teaching curriculum and/or research. A cooperative program may be arranged whereby the areas of Family Resources are combined with other areas through Curriculum and Instruction and lead to the Ed.D.

Child Development; Family Relations (CD&FR)

- 244. *Family and Individual in the Community*. II. 3 hr. PR: One course in the family or sociology/anthropology, or consent. Social psychological analysis of the individual in the family and in other social systems. Study of role relationships, community processes and attitudes and values as they affect the behavior of individual.
- 245. *Family Development*. I. 3 hr. PR: CD&FR 144 or consent. Family development in cross-cultural and historical perspectives. The contemporary family with special attention to social class differences and use of life cycle and developmental task concepts as analytic tools.
- 246. *Adolescent Development*. I. 3 hr. PR: CD&FR 141, 142. Adolescent in contemporary American culture, including normative physical, social, and personality development; relationships within various typical social settings (e.g., family, school, community, peer group).
- 247. *Parenting*. I, S. 3 hr. Definition of parental needs required for parenting. Explanation of types and results of parenting. Causes of child abuse and neglect — generation to generation and situational.
- 284. *Special Topics in Child Development*. I, S. 1-4 hr. per sem. PR: Written consent.
- 288. *Special Topics in Family Relations*. II, S. 1-4 hr. per sem. PR: Written consent.
- 341. *Cognitive Development of the Child*. II. 3 hr. PR: CD&FR 141 and 142 or consent. Piaget's basic theory, including his view of perceptual, symbolic, motor and logico-mathematical development, across the life span. (Offered in Summer in alternate odd years.)
- 343. *Language Development in the Child*. I. 3 hr. PR: Consent. Investigation of the origins and acquisitions of language in children with an emphasis on research and the theoretical issue that explains language as part of man's general cognitive functioning.

345. *Socio-Emotional Development of the Child*. II, S. 3 hr. PR: CD&FR 141 and 142 or consent. A study and examination of contemporary theory and research into various facets of the socialization process in infancy and childhood. (*Offered in Summer in alternate even years.*)
347. *Comparative Study of the Family*. I, II. 3 hr. PR: CD&FR 144 or consent. The comparative method as a framework for family analysis. The family as both an independent and dependent variable in social change. Alternative methods for achieving similar cultural objectives. Converging patterns in the contemporary world setting.
348. *Theories of Child Development*. S. 3 hr. PR: CD&FR 141 or consent. Examination of major theoretical conceptions of child development. Work of Werner, Piaget, Freud, Erikson, and the American learning theorists compared and contrasted.
384. *Special Topics in Child Development*. II, S. 1-4 hr. per sem. PR: Written consent.
388. *Special Topics in Family Relations*. I, S. 1-4 hr. per sem. PR: Written consent.

Family Resources — Research (Far. R.)

390. *Research Methods in Family Resources*. I, II. 3 hr. PR: Introductory statistics or written consent. Research methodology, experimental design, and statistical analysis as relevant to problems in home economics.
391. *Assigned Topics*. I, II, S. 1-6 hr. per sem.; max. 9 hr. Required of all students writing thesis.
490. *Teaching Practicum*. I, II. 1-3 hr. PR: Consent. Supervised practices in college teaching of home economics.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
492. *Specialized Seminar in Home Economics Education*. S. 1-3 hr. PR: Consent.
493. *Special Seminar in Child Development and Family Relations*. S. 1-3 hr. PR: Consent.
495. *Specialized Seminar in Rehabilitation*. S. 1-3 hr. PR: Consent.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of the student's program.
497. *Research*. I, II, S. 1-15 hr.
498. *Thesis*. I, II, S. 1-6 hr. PR: Consent.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in its academic and cultural programs.

Family Resources — Seminars (Far. S.)

282. *Seminar in Clothing or Textiles*. I, II, S. 1-4 hr. per sem.; max. 9 hr. PR: Written consent. Significant contemporary issues in clothing or textiles.
283. *Seminar in Housing and Design*. I, II, S. 1-4 hr. per sem.; max. 9 hr. PR: Written consent; 12 hr. housing and design courses. Significant contemporary issues in housing or design.
285. *Seminar in Foods and/or Institution Administration*. I, II, S. 1-4 hr. per sem.; max. 9 hr. PR: Written consent. Significant contemporary issues in foods and/or institution administration.

286. *Seminar in Home Management or Family Economics*. I, II, S. 1-4 hr. per sem.; max. 9 hr. PR: Written consent. Significant contemporary issues in home management or family economics.
287. *Seminar in Nutrition*. I, II, S. 1-4 hr. per sem.; max. 9 hr. PR: Written consent. Significant contemporary issues in nutrition.
387. *Special Topics*. I, II, S. 1-4 hr. per sem.; max. 9 hr. PR: Written consent. Review and discussion of recent progress and/or special problems in foods and nutrition research.

Foods; Institution Administration (FIA)

255. *Food Quality Evaluation*. I, S. 3 hr. PR: FIA 55 and organic chemistry. Evaluation and interpretation of food-related experiments and technical reports. Proximate method of nutrient analysis of food. Introduction to food experimentation.
257. *Food Systems Management IV*. I. 3 hr. PR: FIA 154 and 158. Clinical experience in food systems accounting, cost control, and employee management. Includes administrative experience, employee evaluation, counseling and training.
258. *Food Systems Management V*. II. 6 hr. PR: FIA 257. Experience under supervision in planning, production, cost control, and employee management in an institution. Selection of setting and type of experience determined by needs of students.
355. *Experimental Foods*. II. 3 hr. (Lec. and Lab.) PR: FIA 55, Chem. 131 or consent. Factors involved in food processing under various conditions.

Home Economics Education (H.E. Ed.)

211. *Community Internship*. I, II. 3 hr. PR: H.E. Ed. 281. Supervised participation in home economics related to business and industry, and extension and community agencies.
219. *Occupational Home Economics*. II. 3 hr. Prepares teachers to implement occupational home economics programs. Emphasis on organizing and administering programs developing laboratory and work experiences, recruiting students, and evaluating progress.
278. *Vocational Home Economics*. II. 3 hr. PR: Senior standing or consent. Develops an understanding of federal vocational legislation to enable an individual develop program proposals and implements programs in vocational education. *(Course will not be offered in Fall 1981-82.)*
281. *Contemporary Problems in Home Economics*. I. 3 hr. Applies the broad-based philosophy of home economics to current individual family and community problems, e.g., societal impact on families, changing consumer market, changing roles, day care, diminishing energy resources, career education, etc.
284. *Special Topics*. I, II, S. 3 hr. Individual or group research on a current concern in the field of home economics.
311. *Home Economics Curriculum*. I, II, S. 3 hr. PR: Experience in teaching home economics or consent. Theory and research in home economics curriculum. Change in existing programs and development of new programs. *(Course will not be offered in 1981-82.)*
312. *Supervision in Home Economics*. I, II, S. 3 hr. PR: Teaching experience and consent. For home economics teachers preparing to serve as supervising teachers in off-campus training centers. *(Course will not be offered in 1981-82.)*
313. *Evaluation in Home Economics*. I, II, S. 3 hr. PR: 30 hr. of family resources, 7 hr. of education or consent. Experience in devising, selecting, and using a variety of

techniques for evaluating progress toward cognitive, affective, and psychomotor objectives in home economics.

- 314. *Adult Education*. I, II, S. 3 hr. PR: Consent. Psychology of adult learning, philosophy, types of programs to include organization, methods and techniques, and leadership training in working with adult groups. (Course will not be offered in Fall, Summer 1981-82.)
- 381. *Special Topics in Home Economics Education*. I, II, S. 1-4 hr.; max. 9 hr. PR: Senior standing and written consent. Home economics education at secondary, college, and adult levels. Current research and trends in selected areas.
- 395. *Practicum: Supervision of Student Teachers*. I, II, S. 1-12 hr. PR: Degree and teaching certificate in home economics or consent.

Home Management; Family Economics (HMFE)

- 261. *Consumer Economics*. II. 3 hr. Understanding the consumer's role in our economy. Study of research methods and techniques used to identify, understand, and solve consumer problems.
- 262. *Introduction to Homemaker Rehabilitation*. II. 3 hr. A comprehensive coverage of the historical development, philosophy, legislation, community resources, research and professional literature provides a base of knowledge needed by the student to enter the field of homemaker rehabilitation.
- 363. *Community Resources for Disabled Homemakers*. I. 3 hr. Provides students with knowledge and skills needed to utilize other disciplines in the team approach to rehabilitating handicapped homemakers. Presentations by team members, such as physicians, nurses, counselors, therapists, social workers, etc.
- 364. *Home Management for Disabled Homemakers*. II. 3 hr. PR: HMFE 262 or consent. Provides students with skills to teach home management concepts related to the disabled homemaker in performance of household tasks. Emphasis on work simplification, body mechanics, equipment selection, and adaptation to promote independent living.
- 365. *Homemaker Rehabilitation Practicum*. I, II, S. 6 hr. PR: HMFE 363, 364; Rehab. 300, 310, 312. Field experience under supervision designed to develop student's knowledge and skills needed for working in homemaker rehabilitation. A variety of settings, including 6 weeks of resident experience to allow working directly with clients.

Housing and Design (HD)

- 233. *Decorative Arts I*. I. 3 hr. PR: 9 hr. HD. The decorative arts — antiquity to American periods.
- 234. *Decorative Arts II*. 3 hr. PR: HD 233. The decorative arts — American periods to present.
- 235. *Contemporary Interior Design*. I. 3 hr. PR: HD 233, 234. The study of the history of interiors, 1900-present.
- 238. *Portfolio Design*. I, II, S. 3 hr. PR: Senior standing. Development and preparation of a portfolio for Interior Design and N.C.I.D.A. qualifications examination and placement.
- 239. *Interior Design Field Experience*. I, II, S. 3-9 hr. (May be repeated to 9 hr.) PR: Written consent, senior standing. Opportunity to learn and work within a professional environment with practicing designers.
- 383. *Special Topics in Housing and Design*. I, II, S. 1-4 hr. per sem. PR: Written consent.

Nutrition (Nutrn.)

- 270. *Nutrition Education. I.* 2 hr. PR: Nutrn. 71, 3 hr. in educational psychology, and consent. Problems and methods in nutrition education at all levels of society, and with various types of individuals and groups.
- 271. *Human Nutrition. I.* 3 hr. PR: Nutrn. 71, physiology; Corequisite: biochemistry. Role of food nutrients in physiological and biochemical processes of the body; nutritional needs of healthy individuals under ordinary conditions.
- 272. *Community Nutrition I. II.* 2-3 hr. PR: Nutrn. 71 or H.E.Ed. 175. Beginning planning for community nutrition for individuals and families at various stages of life cycle. Roles of agencies and professional groups. Clinical experience in community facilities for 3rd credit hour optional.
- 273. *Community Nutrition II. I.* 3 hr. PR: Nutrn. 272. Advanced course in public-health nutrition; includes programs, issues, and factors in development of nutrition policy at the national and international levels.
- 275. *Clinical Nutrition I. II.* 3 hr. PR: Physiology, Nutrn. 271. General aspects of nutritional care of the patient. Role of the clinical dietitian on health team. Basic methods and clinical experience of current concepts to problems of dietary management in dealing with diseases and stress.
- 276. *Clinical Nutrition II. I.* 4 hr. PR: Nutrn. 271, 275. Adaptations of normal diet for more complex diseases whose prevention or treatment is largely influenced by diet. Clinical experience with patient care related to the condition will be concurrent with the didactic material.
- 277. *Clinical Nutrition III. II.* 6 hr. PR: Nutrn. 271, 275, 276. Complex dietary treatment of disorders, involving several biological systems. Effects of hormonal and biochemical changes. Complete responsibility for dietary care of assigned patients.
- 278. *Dietetic Technical Writing and Evaluation. I.* 3 hr. PR: Stat. 101 or Stat. 311 and consent. Foods, nutrition, and dietetics information resources. Evaluation and interpretation of foods and nutrition data. Critical evaluation of various types of publications in the discipline and technical writing. Nutrient evaluation methods.
- 279. *Dietetics As a Profession. II.* 1 hr. PR: Consent. The professional role of the nutritionist in modern society, dealing with problems involving ethics, attitudes, and values, case study approach.
- 370. *Human Nutrition Concepts and Application. II.* 3 hr. PR: Biochemistry. Critical study of the nutrient evaluation methods and the nutrient requirements of the human in health and disease, and scope of its application.
- 387. *Special Topics. I, II, S.* 1-4 hr. per sem.; max. 9 hr. PR: Written consent. Review and discussion of recent progress and/or special problems in foods and nutrition research.
- 494. *Seminar in Human Nutrition. I, II, S.* 1-3 hr.

Textiles and Clothing (Tx&Cl)

- 224. *Flat Pattern Design. I, II.* 3 hr. PR: Tx&Cl 22, 27, 123, or consent. Opportunity for creative expression and for understanding of pattern design through flat pattern. Costumes designed and constructed by the student.
- 225. *Tailoring. I, II.* 3 hr. PR: Tx&Cl 22, 27, 224. Tailoring suits and coats. Emphasis on professional techniques, advanced fitting, and construction of garments.
- 226. *Advanced Fashion Design. II.* 3 hr. PR: Tx&Cl 224 or consent. Art principles and fashion terminology explored to increase the ability to analyze costume designs. Ex-

amination of different sources of design inspiration. Techniques of drawing from a live fashion model and various media for costume design presentation.

227. *Advanced Textiles*. I, II. 3 hr. PR: Tx&Cl 27, 127. Comparative characteristics of all textile fibers are presented. Physical and chemical properties are explained with reference to fiber morphology and/or manufacturing processes.
382. *Special Topics in Clothing or Textiles*. I, II, S. 1-4 hr. per sem. PR: Written consent.

FOREIGN LANGUAGES

Robert J. Elkins, *Chairperson of the Department*

205-B Chitwood Hall

Degree Offered: M.A.

Graduate Faculty: Members Elkins, Harss, Murphy, Taylor, and Whitley. Associate Members Beauchemin, Bendana, Claesges, Conerly, Cummins, R. W. Dunbar, Gonzalez, Harris, Huffman, Ponchie, Prentiss, Renahan, Schlunk, Siemens, and Spleth.

The Department of Foreign Languages offers graduate study in French, German, Greek, Latin, Russian, and Spanish literature and culture, in linguistics, in English as a second language, in language teaching methods, including the teaching of English as a second language, and in bibliography and research. Candidates for the master's degree are accepted in any of the above areas as long as they fulfill all requirements of the Master of Arts (M.A.) listed below.

A student who wishes to do graduate work in the department should apply to the chairman, who will serve as temporary adviser until an advisory committee is appointed to direct the student's work. The committee will meet during the first semester of the student's study. The committee is provisionally appointed but can be altered by the student in consultation with the chairman. The student will be expected to have an undergraduate major in the areas of interest or be required to make up certain deficiencies. The student should normally show an average of at least 3.0 (B) in undergraduate foreign language courses.

Requirements

1. Thirty-six hours of graduate work for the Master of Arts exclusive of 490 (Teaching Practicum) and 499 (Graduate Colloquium). Research, including thesis, may count for no more than 9 hours of this requirement.
2. Minimum of four courses in literature.
3. Minimum of one course in linguistics.
4. Minimum of one course in culture.
5. Reading knowledge of two foreign languages or demonstration of fluency in one foreign language as determined by the student's committee. Fluency will be demonstrated by successful completion of a two-hour oral and written examination covering all four language skills. The language examination(s) must be passed one semester prior to graduation.
6. Demonstration of ability to undertake research and to write clearly and succinctly. Student is to demonstrate this ability by one of the following:
 - a. A or B in Bibliography and Methods 365.
 - b. Presentation of acceptable Master's thesis.

- c. Publication of one or more acceptable research articles.
- d. Acceptance of two research papers of B quality or better as judged by three members of the department. Members of the committee to be determined by the department chairman. If only one vote is negative, a fourth member will be asked to read the paper.

7. Seven-hour written examination based upon the reading list. Student will have a reading list composed of seven sections. Six sections will be selected from the master reading list. The seventh section may be drawn up by the student and the student's major adviser or selected from the master reading list. Candidates who write a thesis will have the number of sections (and hours of the examination) reduced by three. The thesis, if chosen, will be discussed and evaluated during the oral exam.

8. Two-hour oral examination based upon course work and/or thesis.

All graduate assistants are required to complete Language Teaching Methods 421 as part of the work in the major fields unless they have had a similar course in their undergraduate study. The candidate's committee, together with the student, will determine the distribution of courses and the thesis requirement in the light of the student's aims and needs. The committee also will administer written and oral comprehensive examinations near the end of the candidate's course of study. Both oral and written examinations are normally given only twice a year, in November and in April.

Graduate assistants are required to enroll each semester in L.T.M. 490 and L.T.M. 499, although these credits do not count toward the master's. They are also expected to attend the Speech Communication workshop and to enroll in Speech Communication 496.

Special Courses of Study Abroad

These courses are currently offered in Spanish, French, and German, and are listed in the *WVU Summer Session Schedule of Courses*, but they usually begin early, before the end of May, and end around the first of July. Spanish courses are held in Colombia or Madrid, Spain; French courses are conducted at Cannes in France or Montreal, Canada; in Germany classes are held in St. Goarshausen. Students normally register for two courses at WVU, but all work is carried on overseas. A fall semester may be offered at the University of Caen. Students may enroll for as many as 15 semester hours of credit.

Bibliography and Research (Bibgy.)

365. *Methods of Research*. I. 3 hr.

Classics (Class.)

201. *Roman Novelists*. I. 3 hr. PR: Class. 109, 110, or equiv.

202. *Roman Comedy*. II. 3 hr. PR: Class. 109, 110, or equiv.

235. *Roman Epic*. I. 3 hr. PR: Class. 109, 110, or equiv. (*Course will not be offered in 1981-82.*)

292. *Pro-Seminar in Latin or Greek Literature*. 1-6 hr. Special topics.

392. *Seminar in Latin or Greek Literature*. 1-6 hr. Special topics.

497. *Research*. 1-15 hr.

Foreign Literature in Translation (FLIT)

- 211. *Chinese Literature in Translation*. I. 3 hr. Survey of selected works of Chinese literature from ancient times through the eighteenth century.
- 221. *Japanese Literature in Translation*. II. 3 hr. Survey of selected works of Japanese literature from ancient period to the mid-nineteenth century and an introduction to a few works of the modern period.
- 292. *Pro-Seminar*. I, II, S. 1-6 hr.* PR: 6 hr. of upper-division literature courses or consent. Special topics.
- 392. *Seminar*. I, II, S. 1-6 hr.* PR: 6 hr. of upper-division literature courses or consent. Special topics.

French (Frch.)

- 203. *Conversational French*. I. 3 hr. PR: Frch. 110 or consent. Intensive spoken French.
- 217. *French Civilization*. II. 3 hr. PR: 12 hr. of French.
- 221. *The Romantic Movement*. I. 3 hr. PR: 18 hr. of French or consent.
- 222. *French Realism*. II. 3 hr. PR: 18 hr. of French or consent.
- 229. *Literature of the Sixteenth Century*. I. 3 hr. PR: 18 hr. of French or consent.
- 231. *Phonetics and Pronunciation*. II. 3 hr. PR: 12 hr. of French or equiv.
- 292. *Pro-Seminar*. I, II, S. 1-6 hr.* Special topics.
- 305. *Fundamentals for Reading French*. I. 3 hr. PR: Graduate or upper-division standing. Frch. 305 and 306 is intended for graduate students from other departments to teach them to read general and technical French.
- 306. *Reading French*. II. 3 hr. PR: 12 hr. of French or equiv. or Frch. 305. Graduate students may meet a doctoral foreign language requirement by achieving a grade of B or better in this course.
- 326. *Literary Criticism*. II. 3 hr. PR: B.A. in French or consent.
- 337. *Moliere*. II. 3 hr. PR: B.A. in French or consent.
- 344. *Explication de Textes*. II. 3 hr. PR: 24 hr. of French or equiv.
- 371. *The Modern Novel to 1930*. I. 3 hr. PR: B.A. in French or consent.
- 372. *The Novel After 1930*. II. 3 hr. PR: B.A. in French or consent.
- 381. *Medieval French Literature*. II. 3 hr. PR: Lingu. 342 or consent.
- 392. *Seminar*. 1-6 hr.* Special topics.
- 497. *Research*. 1-15 hr.

German (Ger.)

- 243. *Medieval German Literature*. I. 3 hr. PR: 18 hr. of German or consent.
- 245. *Classicism and Romanticism*. I. 3 hr. PR: 18 hr. of German of consent. Critical study of German literature from 1750 to 1830.

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

246. *The Liberal Age*. II. 3 hr. PR: 18 hr. of German or consent. Critical study of German literature from 1830 to 1880.
247. *The Age of Crisis*. I. 3 hr. PR: Ger. 4 or consent. A critical study of German literature from 1880 to present.
292. *Pro-Seminar*. 1-6 hr.* Special topics.
301. *Independent Reading*. I. 3 hr. Supervised reading for students who wish to do intensive work in any field of interest.
302. *Independent Reading*. II. 3 hr. Continuation of Ger. 301.
305. *Fundamentals for Reading German*. I. 3 hr. PR: Graduate or upper-division standing. Ger. 305-306 is intended for graduate students from other departments to teach them to read general and technical German.
306. *Reading German*. II. 3 hr. PR: 12 hr. of German or equiv. or Ger. 305. Graduate students may meet a doctoral foreign language requirement by achieving a grade of B or better in this course.
361. *Lyric Poetry*. I. 3 hr. PR: 24 hr. of German or consent.
376. *The Modern Novel*. I, II. 3 hr. PR: 24 hr. of German or consent. A study of representative novels from 1900 to 1945.
392. *Seminar*. 1-6 hr.* Special topics.
497. *Research*. 1-15 hr.

Language Teaching Methods (LTM)

221. *The Teaching of Foreign Languages*. I. 3 hr. Required of all students who are prospective foreign language teachers on the secondary level.
292. *Pro-Seminar*. 1-6 hr.* Special topics.
392. *Seminar*. 1-6 hr.* Special topics.
421. *Teaching Foreign Language in College*. I, II. 1-6 hr.* Methods and techniques of teaching a foreign language at the college level.
490. *Teaching Practicum*. I, II, S. 1-3 hr.
497. *Research*. 1-15 hr.*
499. *Graduate Colloquium*. I, II, S. 1-6 hr.* Required each semester of all graduate assistants in Department of Foreign Languages.

Linguistics (Lingu.)

202. *Phonology*. I. 3 hr. PR: Lingu. 1, 111 or consent. Description of sounds and sound systems in language. Articulatory phonetics. Structuralist and generative approaches to phonetics.
211. *History of the Spanish Language*. II. 3 hr. PR: 18 hr. of Spanish and Lingu. 111 or consent. Evolution of Castilian from Vulgar Latin to its modern standard form through a study of historical phonology, morphology, and syntax together with the external factors which influenced the development of the language.
217. *Structure of Spanish*. I. 3 hr. PR: 18 hr. of Spanish and Lingu. 111 or consent. Description of the phonological or grammatical systems of Spanish, with emphasis on contrastive analysis (Spanish English) and applied linguistics.

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

241. *History of the French Language*. II. 3 hr. PR: Consent. Evolution of French from Vulgar Latin into the Modern French standard through a study of historical phonology, morphology, and syntax together with the external factors which influenced the development of the language.
247. *Structure of Modern French*. I. 3 hr. PR: 18 hr. of French and Lingu. 111 or consent. Study of phonology, morphology, and syntax of modern French together with a contrastive analysis of French and English.
251. *History of the German Language*. I. 3 hr. PR: 18 hr. of German or consent. Historical development of standard German with emphasis on its relationships to the other German languages and dialects.
257. *Structure of German*. II. 3 hr. PR: 18 hr. of German and Lingu. 111 or consent. Phonological, morphological, and syntactical structure of contemporary German language.
261. *History of the Russian Language*. I. 3 hr. PR: 18 hr. of Russian and Lingu. 111 or consent. Development of Russian from Indo-European to the present.
267. *Structure of Russian*. II. 3 hr. PR: 18 hr. of Russian and Lingu. 111 or consent. Phonological, morphological, and syntactical structure of contemporary Russian.
283. *Transformational Grammar*. S. 3 hr. PR: Lingu. 111 and consent. Emphasis on generative syntax in English, German, Romance, and Slavic languages.
284. *History of Linguistics*. I. 3 hr. PR: Lingu. 111 or consent. Development of linguistics from Greeks and Romans to contemporary researchers with concentration on major linguists and schools of the nineteenth and twentieth centuries.
287. *Psycholinguistics*. I. 3 hr. PR: Lingu. 111 or consent. Provides an insight into the many areas of psycholinguistic study, including language acquisition, sentence processing, animal communication, dichotic listening, aphasia, and semantics.
288. *Dialectology*. I. 3 hr. PR: Lingu. 1, 111 or consent. Introduction to linguistic study of geographical and social variation in language.
292. *Pro-Seminar*. 1-6 hr.* Special topics.
313. *Old Spanish*. II. 3 hr. PR: Consent.
343. *Old French*. I. 3 hr. PR: Consent. Study of the oldest monuments of the French language including the *Chanson de Roland* and *Aucassin et Nicolette* in an effort to trace the evolution of Francien, Anglo-Norman, and Picard and Vulgar Latin.
353. *Middle High German I*. I. 3 hr. PR: 18 hr. of German and Lingu. 111 or consent. Study of the linguistic developments of Middle High German from the eleventh to the fifteenth centuries with illustrative readings from the *Nibelungenlied*.
354. *Middle High German II*. II. 3 hr. PR: Lingu. 353. Continuation of Lingu. 353 with illustrative readings from the Middle High German lyric poets and the courtly epics.
392. *Seminar*. 1-6 hr.* Special topics.
491. *Advanced Study*. 1-6 hr.*
497. *Research*. 1-15 hr.*

Russian (Russ.)

292. *Special Topics*. 1-6 hr. PR: 18 hr. of Russian or equiv.

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

305. *Fundamentals for Reading Russian*. I. 3 hr. PR: Graduate or upper-division standing. Russ. 305-306 is intended for graduate students from other departments to teach them to read general and technical Russian.
306. *Reading Russian*. II. 3 hr. PR: 12 hr. of Russian or equiv. or Russ. 305. Graduate students may meet a doctoral foreign language requirement by achieving a grade of B or better in this course.

Spanish (Span.)

221. *Literature of the Golden Age to 1635*. I. 3 hr. PR: 18 hr. of Spanish or equiv.
222. *The Golden Age After Lope De Vega*. II. 3 hr. PR: 18 hr. of Spanish or equiv.
223. *Estudios De Estilo*. I. 3 hr. PR: 18 hr. of Spanish or equiv.
292. *Pro-Seminar*. 1-6 hr.* Special topics.
315. *Lyric Poetry*. I. 3 hr. PR: 12 hr. of Spanish or equiv.
324. *Explicacion De Textos*. II. 3 hr. PR: 18 hr. of Spanish or equiv.
325. *The Picaresque Novel*. I. 3 hr. PR: 18 hr. of Spanish or equiv.
391. *Cervantes*. II. 3 hr. PR: 18 hr. of Spanish or consent.
392. *Seminar*. 1-6 hr.* Special topics.
395. *Sixteenth Century Literature*. I. 3 hr. PR: 18 hr. of Spanish or consent.
497. *Research*. 1-15 hr.*

FOREST RESOURCES SCIENCE

Jack E. Coster, Chairperson, Division of Forestry

322-A Percival Hall

Degree Offered: Ph.D.

Graduate Faculty: Members Brock, Carvell, Cech, Hamilton, Koch, Lee, Michael, Samuel, Smith, Tajchman, White, and Wiant. Associate Members E. Bammel, L. Bammel, Hicks, Whitmore, and Zinn.

Doctor of Philosophy

A candidate for the Doctor of Philosophy degree in Forest Resources Science may choose as the major field of study forest science, wood science, or wildlife management. Within these major fields of study, specialization is limited only by the range of competencies in the graduate faculty.

Curriculum requirements of all candidates include a block of graduate courses in the major field which will constitute a comprehensive review of the significant knowledge in that field, and a block of graduate courses in a minor area of study. A minimum of 60 semester hours beyond the bachelor's degree and exclusive of the dissertation will be required.

The research work for the doctoral dissertation must show a high degree of scholarship and must present an original contribution to the field of forest resources science. In addition to course work and the dissertation, the candidate is required to pass a qualifying examination and a final examination.

[Courses are listed under Master of Science in Forestry, pages 171-174.]

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

FORESTRY

Jack E. Coster, *Chairperson, Division of Forestry*

322-A Percival Hall

Degree Offered: M.S.F.

Graduate Faculty: Members Brock, Carvell, Cech, Lee, Tajchman, White, Wiant, Yandle, and Zinn. Associate Member Hicks.

Master of Science in Forestry

Students seeking admission to the program leading to the degree of Master of Science in Forestry (M.S.F.) in the College of Agriculture and Forestry should have completed an undergraduate curriculum in forestry similar to that offered at WVU, and should have an academic record well above average. A student whose undergraduate degree is in a field other than forestry will ordinarily be required to take supplemental undergraduate courses. Candidates for the degree may major in forest biometry, forest ecology, forest economics, forest genetics, forest hydrology, forest meteorology, forest management, silviculture, or wood industry. The candidate must complete 30 credits of approved study, 6 of which shall constitute a thesis. The program ordinarily requires two years of residence.

Master of Science

The Division of Forestry offers programs leading to the degree of Master of Science (M.S.) for students who wish to major in a forestry-related field (e.g., recreation, wildlife management), but do not wish to pursue the specific Master of Science in Forestry route. Applicants should have a bachelor's degree, with good academic performance and an appropriate background in the subject matter of the chosen field. With the exception of those majoring in recreation, candidates must complete 30 credits of approved study, 6 of which shall constitute a thesis. Students majoring in recreation have the option of earning the degree on the basis of 30 hours with a thesis or 36 hours without a thesis. These programs ordinarily require two years of residence.

Forestry (For.)

- 220. *Forest Policy and Administration*. I and II. 3 hr. PR: Upperclass forestry major or consent. Forest policy in the United States; important federal and state laws; administration of public and private forests; problems in multiple-use forestry.
- 226. *Remote Sensing of Environment*. II. 2 hr. PR: Math. 3, 4. Measurement and interpretation of natural resources and environment from photography, radar, infrared, and microwave imagery.
- 233. *Principles of Industrial Forestry*. II. 3 hr. PR: Forestry senior or consent. Analysis and case studies of problems pertinent to the integration of wood conversion technology with principles of production, marketing, and management.
- 419. *Microclimatology*. II. 3 hr. PR: Consent. A description and quantitative treatment of climate near the ground in terms of physical and physiological processes of energy and mass exchange.
- 470. *Special Topics in Forestry, Wood Science, Wildlife, or Recreation*. I, II, S. 1-6 hr.
- 474. *Seminar in Forest Hydrology and Climatology*. I, II. 1 hr. PR: Consent.

480. *Principles of Research*. I, II. 2 hr. The specific method as applied in the formal, concrete, and normative sciences, with special emphasis on forestry-related research plans and reports.
490. *Teaching Practicum*. I, II. 1-6 hr. PR: Consent. Supervised practices in college teaching of forest resources management, wood science, wildlife management resources, and recreation and parks.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled classes.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent.
497. *Research*. I, II, S. 1-15 hr.
498. *Thesis*. I, II, S. 1-6 hr. PR: Consent.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet resident requirements, use the University's facilities, and participate in its academic and cultural programs.

Forest Hydrology (F. Hyd.)

241. *Forest Hydrology: Principles*. I. 3 hr. PR: F. Hyd. 142 or graduate standing. Description and quantitative treatment of the hydrologic cycle in nature, with primary emphasis on the role of forests and terrain.
242. *Forest Hydrology: Practices*. II. 3 hr. PR: F. Hyd. 241. Applications of forest hydrology and climatology in the management of forest land for optimum yields of water, and to minimize erosion, pollution, and flood damage.
243. *Forest Water Quality*. I. 3 hr. PR: Forestry major or consent. Influences of natural forest cover, forest land uses, and harvesting practices on selected water quality parameters that can be detected in simple field and laboratory tests.
244. *Watershed Management*. I, II. 3 hr. PR: F. Man. 12, 211. (Primarily for forest management majors.) Influences of silvicultural practices and forest management activities on the hydrology of forested catchments. (Students with credit for F. Hyd. 241 may not receive credit for F. Hyd. 244.)

Forest Management (F. Man.)

200. *Forest Measurement, Interpretation, Wildlife Management*. S. 5 hr. PR: Biol. 51; C.E. 5; F. Man. 122. Application and study of forest resources practice with emphasis on field problems. (Course will be taught during four consecutive 6-day weeks.)
201. *Forest Resources Management Southern Trip*. S. 1 hr. PR: F. Man. 200 or consent. One-week trip to Southern Pine Region to observe forest management practices on private and public lands.
211. *Silvicultural Systems*. I. 4 hr. PR: Forestry major or consent; F. Man. 12. Principles of regeneration cuttings, intermediate cuttings, and cultural operations, with their application to forest stands.
213. *Regional Silviculture*. I. 2 hr. PR: Forestry major or consent; F. Man. 12; PR or Conc.: F. Man. 211. Major forest types of the United States: their composition, management, problems, and silvicultural treatment.
215. *Principles of Artificial Forestation*. II. 3 hr. PR: Forestry major or consent; F. Man. 12. Seeding and planting nursery practice; phases of artificial regeneration.
216. *Forest Genetics and Tree Improvement*. II. 3 hr. PR: Forestry major or consent; Gen. 272 or equiv., or consent. Forest genetic principles and their application to forest

tree improvement, including crossing methods, selection systems, and other techniques.

222. *Advanced Forest Mensuration*. II. 3 hr. PR: Forestry major or consent; F. Man. 122. Measurement of growth and yield; statistical methods applied to forest measurement problems.
230. *Principles of Forestry Economics*. I, II. 3 hr. PR: Forestry major or consent; Econ. 51 and 52 or equiv. Production, distribution, and use of forest goods and services. Emphasis on analytical methods and techniques dealing with forest economic problems.
232. *Forest Finance*. II. 2 hr. PR: Forestry junior or consent. Interest, discount, and rate earned, in forest production and exploitation. Particular reference to determining value of standing timber, appraisal of forest damages, and forest taxation.
233. *Forest Management*. I. 4 hr. PR: Summer Camp; PR or Conc.: Forestry major or consent; F. Man. 211. Principles of sustained yield forest management. Organization of forest areas, selection of management objectives, application of silvicultural systems, and regulation of cut. Forest management plan.
234. *Integrated Forest Resources Management*. I, II. 3 hr. PR: Forestry major or consent; senior standing. Analysis and planning for management of forest resources. Primarily involves carrying out a major management problem assignment, with actual forest tracts as focal point.
330. *Advanced Principles of Forestry Economics*. II. 3 hr. PR: Econ. 51, 52 or equiv.; F. Man. 230 or equiv. Intensive study of both micro- and macroeconomics of forestry.
411. *Environmental Relationships in Hardwood Forests*. I. 3 hr. PR: F. Man. 211. Environmental factors affecting establishment, composition, and growth of hardwood forests.
412. *Silvicultural Practices for Hardwood Forest Types*. II. 3 hr. PR: F. Man. 211, 213. Designing proper silvicultural systems for managing Appalachian hardwood stands; reconstructing stand histories, recognizing problems, and prescribing appropriate silvicultural treatment.
431. *Advanced Forest Regulation*. I, II. 2 hr. PR: F. Man. 233 or equiv. Intensive study of area and volume regulation suitable for applied forestry in the United States.
472. *Seminar in Silviculture*. I, II. 1-6 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of silviculture with emphasis on hardwood forest types.
473. *Seminar in Forest Management*. 1 hr.

Wood Science (Wd. Sc.)

200. *Forest Measurement Field Practice*. S. 3 hr. (Pass-Fail grading.) PR: Forestry major, Biol. 51, C.E. 1, F. Man. 122. Application of surveying and mensurational practices with emphasis on field problems.
201. *Wood Industries Field Trip*. S. 2 hr. (Pass-Fail grading.) PR: Wd. Sc. 234. A two-week trip to observe manufacturing methods and techniques of commercial wood industry plants. Plants visited include furniture, plywood, veneer, hardboard, particle board, pulp and paper, sawmilling, and preservation. (Offered in odd years.)
230. *Wood Machining*. II. 2 hr. PR: Consent. Introduction to basic concepts of wood machining with emphasis on production equipment and furniture manufacturing.
231. *Wood Finishing*. I. 3 hr. PR: Forestry major or consent; Wd. Sc. 121. Surface preparation, composition of finishing materials, equipment, techniques, defects, troubleshooting, and quality control.

232. *Wood Adhesion: Theory and Practice*. I. 2 hr. PR: Wd. Sc. 123 and 141. Detailed theoretical introduction and examination of different types of adhesives and gluing techniques used in the wood industry.
234. *Statistical Quality Control*. I. 3 hr. PR: Forestry major or consent; Wd. Sc. 134. Methods used to control quality of manufactured wood products. Control charts of variables and attributes. Acceptance sampling techniques.
235. *Light-Frame Wood Construction*. I. 2 hr. PR: Forestry major or consent. Use of wood in light-frame construction. Basic design procedures and construction methods.
240. *Wood Moisture Relationships*. II. 3 hr. PR: Forestry major or consent; Wd. Sc. 123. Principles involved in the relation between wood and moisture, and purposes, effects, and methods of seasoning.
251. *Forest Products Protection*. II. 3 hr. PR: Forestry major or consent; Wd. Sc. 123, 134. Biological organisms responsible for deterioration of wood products, their control by preservative methods, and study of fire retarding methods.
320. *Wood Microstructure*. I. 3 hr. PR: Wd. Sc. 123; senior standing, or consent. Detailed examination of wood microstructure as it relates to processing, behavior, and identification.
473. *Seminar in Wood Utilization*. I, II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of wood utilization.

GENETICS AND DEVELOPMENTAL BIOLOGY

Joginder Nath, Chairperson of the Interdisciplinary Faculty

1120 Agricultural Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Amato, Blaydes, D. F. Butcher, R. L. Butcher, L. Butler, Cech, Charon, Dunbar, Ellingson, Gerencser, J. E. Hall, B. Jones, Kaczmarczyk, Katz, Keller, Kirk, McCafferty, McClung, Mengoli, Nath, Neal, Ong, Overman, Pore, Quinlan, Reyer, Schein, Tryfiates, Ulrich, Van Dyke, Wearden, Williams, and Yelton, Associate Members Montiegel, Thayne, and White.

The M.S. and Ph.D. degrees are offered in Genetics and Developmental Biology, an interdisciplinary program involving the faculty and facilities of a number of departments in the various colleges and schools of the University. A student may concentrate in Genetics or Developmental Biology. The areas in which specialization is offered are as follows: *Genetics*: Biochemical and molecular genetics, cytogenetics, developmental genetics, forest genetics, human genetics, plant genetics, population and quantitative genetics, and animal breeding; *Developmental Biology*: molecular aspects of development, experimental morphogenesis, teratology, regeneration, oncology, descriptive embryology, and life cycles of animals and plants.

The student may also minor in one or more other scientific fields.

The object of this program is to build upon a well rounded scientific foundation, a specialized knowledge of the concepts and methods in a discipline, chosen by the student, which will enable the student to pursue a productive career in teaching and/or research. Responsibility for a student's program is vested in a graduate committee charged with arranging the student's course work, conducting examinations, and supervising the research.

Basic training in mathematics, physics, chemistry, and biology is required for admission. Students lacking some prerequisites must fulfill them before graduation. Applications for graduate study should be sent in as early in the year as possible, but no later than April 1 for entry the following August. However, applications are accepted year-round for admission to the program in the following semester. Official transcripts of baccalaureate and/or master's degrees must be sent directly to the WVU Office of Admissions and Records. Three letters of recommendation from science teachers should accompany the application. Application forms can be received from the Office of Admissions and Records. For further information, write to the Chairperson.

Genetics (Gen.)

290. *Crop Breeding*. II. 3 hr. PR: Gen. 171 or 321. Methods and basic scientific principles involved in improvement of leading crops through hybridization, selection, and other techniques. (*Offered in Spring of even years.*)
321. *Basic Concepts of Modern Genetics*. I. 3 hr. PR: 8 hr. biological science and 1 yr. chemistry. Independent inheritance, linkage. Chemical nature of genetic material. Control of phenotype by genetic material. Gene action and coding of genetic material.
325. *Human Genetics*. II. 3 hr. PR: Gen. 171 or 321 or consent. Study of genetic system responsible for development of phenotype in man. (*Offered in Spring of odd years.*)
335. *Population Genetics*. I. 3 hr. PR: Gen. 171 or 321 or consent. Relationship of gene and genotype frequencies in populations of diploid organisms, and effects of mutations, migration, selection, assortive mating, and inbreeding in relation to single gene pairs. Application of these concepts to multigenic inheritance of quantitative traits. (*Offered in Fall of even years.*)
420. *Special Topics*. I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.)
424. *Cytogenetics*. II. 4 hr. PR: Gen. 171 or 321, and Biol. 215 or consent. Emphasis on macromolecules that carry information of the chromosomes, cell division, and the cytological and molecular basis of genetics. Special attention given to visible manifestation of genes, human cytogenetics, cytogenetics of genomes and chromosome morphology, and their evolution. (*Offered in Spring of odd years.*)
426. *Advanced Biochemical Genetics*. II. 3 hr. PR: Gen. 171 or 321 and organic chemistry. Physiological and biophysical concepts of genetic material. Structure and arrangement of genetic units. Nucleic acids as carriers of genetic information. Gene action and amino acid coding. Biochemical evolution of genetic material. Genetic control mechanisms. Biochemistry of mutation. (*Offered in Spring of even years.*)
427. *Genetic Mechanisms of Evolution*. I. 3 hr. PR: Gen. 171 or equiv. Molecular genetic mechanisms which result in evolutionary change. Origin of life, origin and organization of genetic variability, differentiation of populations, isolation and speciation, role of hybridization and polyploidy, and origin of man. (*Offered in Fall of odd years.*)
450. *Seminar*. I, II. 1 hr. per sem. Recent literature pertaining to biochemical, classical, human, molecular and cytological genetics.
497. *Research*. I, II. 1-15 hr.

GEOLOGY

Milton T. Heald, Associate Chairperson of the Department of Geology and Geography
318 White Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Behling, Donaldson, Erwin, Heald, Little, Patchen, Rauch, Renton, Shumaker, Smosna, Ting, and Warshauer. Associate Members Calzonetti, Chen, Dodson, Elmes, Johansen, Lessing, Martis, Overbey, Rowles, and Williams.

The Department of Geology and Geography offers work leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Geology.

Applicants for graduate studies in geology must have as a minimum requirement a bachelor's degree and an overall grade-point average of at least 2.75. Acceptances by the Graduate School and by the Department of Geology and Geography are necessary before admission of any prospective student to the program. All candidates for a graduate degree in geology must submit scores in the general aptitude test of the Graduate Record Examination. An English proficiency test will be given in the evening of the fourth day of classes. Candidates will write a short paper on an assigned geologic topic to demonstrate acceptable writing skills.

Before being admitted to programs leading to the M.S. in Option One or Two or the Ph.D., a student must pass an entrance examination covering Physical, Historical and Structural Geology, Sedimentation-Stratigraphy and Mineralogy. The examination is given from 7-9:30 p.m. on the second day of classes each semester.

Students seeking admission to the Master's program for Option One, or Two, or to the Ph.D. program, must complete the equivalents of all science and mathematics courses required for the B.S. degree in geology at WVU before being admitted to these programs.

In the descriptions that follow, "formal course" means a cataloged lecture or seminar course and "Problem" means a directed, but independent exercise in the solution of a specific problem and the presentation of results.

Master of Science (M.S.)

No later than the beginning of the second semester in residence, the prospective candidate must choose one of four options leading to the Master of Science (M.S.) degree in geology. A minimum grade-point average of 3.0 (B) for all courses must be maintained by M.S. students.

Option One: Master of Science in Geology (M.S.) — Research

This has been the "traditional" option for the Master of Science in geology. Students considering continued studies (Doctor of Philosophy degree) should choose this option.

A minimum of 24 formal-course credits and 6 research credits are required for graduation. A thesis based on original research also is required. With consent of the candidate's advisory committee, the field work need not be done while in residence at WVU.

Required to Graduate: 30 credits; work in three or more emphasis areas; satisfactory completion of comprehensive examination.

Option Two: Master of Science in Geology (M.S.) — Professional Studies

This option is designed specifically for students seeking experience in preparing and presenting professional problems. Students choosing this option would be seeking employment in technical fields rather than continuing studies for a higher degree.

A minimum of 34 formal-course credits and 8 Problems credits are required for graduation. The additional course work in lieu of a thesis is designed to simulate the work of professional geologists as they seek solutions to open-ended problems. Experience in presentation of problems and solutions is an integral part of the program.

Problems credits may be earned in conjunction with off-campus experiences by consent of the candidate's advisory committee.

Required to Graduate: 42 credits; work in three or more emphasis areas; satisfactory completion of comprehensive examination.

Option Three: Master of Science in Geology (M.S.) — Geographic Studies

This program is designed to combine the disciplines of geology and geography to analyze environmental problems that require a knowledge of human activity patterns. Its purpose is to provide students with a background for pursuing careers in industry, government, education and social services which involve management or planning of natural and human environments. Each student, working with a faculty adviser, will be encouraged to develop a specific program tailored to his or her individual needs and goals.

A bachelor's degree and acceptance by the department are required for admission. A minimum of 30 hours of graduate-level course work is required of which 9 hours must be in geology. The student must demonstrate a basic competence in geography and write a thesis and present it to a committee as a final examination to graduate.

Option Four: Master of Science in Geology (M.S.) — Earth Science Education

Students entering this option must have a bachelor's degree. The Earth Science Education student recognizes the need for multidisciplinary studies in planning earth science programs in secondary schools. A candidate in this option will receive a broad background in the philosophy and practice of investigating the earth and in understanding and interpreting for others the results of such investigations.

The candidate and the advisory committee will design a curriculum based on requirements for Earth Science Certification in other states. The state of West Virginia does not grant Earth Science Education certification.

Course work in two or more related fields (e.g., biology, chemistry, geography, physics, agronomy) is required. A minimum of 30 formal-course hours and 10 Problems credits are required.

Required to Graduate: 40 hours; work in four or more emphasis areas.

Emphasis Areas in Geology and Geography

1. Quantitative Methods and Techniques: Stat. 311, Stat. 312, Geol. 396, Geog. 261, (and other disciplines).

2. Geomorphology and Hydrogeology: Geol. 221, 222, 228, 363, 395, (and other disciplines).

3. Sedimentation, Stratigraphy, Low Temperature Geochemistry, and Sedimentary Petrology: Geol. 261, 340, 341, 346, 362, 385, 394.
4. Paleobiology: Geol. 231, 235, 336, 432, (and selected biology courses).
5. Economic Geology, Coal Geology, Petroleum Geology: Geol. 270, 272, 274, 294, 372, 376, 394.
6. Igneous and Metamorphic Geology, High Temperature Geochemistry: Geol. 385, 394.
7. Structural Geology, Geophysics: Geol. 251, 351, 353, 357.
8. Environmental Studies: Geog. 202, 209, 210, 219, 220, 225, 230, 261; Geol. 221, 222, 228, 363, 395.

The designation of specific Geol. 290 and 420 courses and Geol. 219 will be made by the instructor.

Doctor of Philosophy (Ph.D.)

The candidate for the Doctor of Philosophy (Ph.D.) must complete a program of courses outlined by the candidate's doctoral committee with a grade-point average of at least 3.3 in all courses taken each semester. Reading competence in a foreign language is required and comprehensive examinations must be successfully completed. Work on original research is to be presented in a dissertation and defended in an oral examination.

Research

Close cooperation between the West Virginia Geological and Economic Survey, located near Morgantown, and the Department of Geology and Geography makes a large amount of material available for laboratory investigation. This includes the fossil collections of the department and the survey. A large number of samples of drill cuttings from deep wells in West Virginia and adjoining states are housed in the survey. The department also has a number of cooperative projects with the Morgantown Energy Technology Center of the U.S. Department of Energy. Morgantown is conveniently situated for detailed studies of Mississippian, Pennsylvanian, and Permian formations. Mineral products of the region near Morgantown include coal, petroleum, natural gas, and limestone. The occurrence and utilization of these materials can be studied by graduate students interested in economic geology. A permanent summer field camp (Camp Wood) is located in the Folded Appalachians at Alvon, Greenbrier County. The coastal geology program includes an annual trip to the Florida Keys, and three weeks on the shore of Virginia. Additional oceanography courses and research are available at the Marine Science Consortium at Wallops Island, Virginia, with which WVU is affiliated.

Geology (Geol.)

201. *Physical Geology for Teachers*. I, II. 3 hr. PR: High school teaching certificate and consent. Composition and structure of earth and the geologic processes which shape its surface. Credit cannot be obtained for both Geol. 201 and Geol. 1 or 5.
221. *Geomorphology*. II. 3 hr. PR: Geol. 1 or 5. An examination of the physical processes which shape the surface of the earth, with emphasis on fluvial processes and environmental geomorphology. Optional field trip at student's expense.
222. *Glacial Geology*. II. 3 hr. PR: Geol. 1 or 5. Introduction to glaciology and glacial geology, with emphasis on topographic form and the nature of glacial deposits. The

Quaternary history of North America is stressed. Optional field trip(s) at student's expense.

228. *Photogeology*. II. 3 hr. PR: Geol. 127, 151, or consent. Instruction in basic and advanced techniques of air photo interpretation.
231. *Invertebrate Paleontology*. I. 4 hr. PR: Geol. 3, 4, or consent. Invertebrate fossils: biologic classification, evolutionary development, ecology, and use in correlation of strata.
235. *Introductory Paleobotany*. I. 4 hr. PR: Geol. 3. Resume of development of principal plant groups through the ages, present distribution, mode of occurrence and index species, methods of collection. Required Saturday field trips at student's expense.
251. *Advanced Topics in Structural Geology*. II. 2-4 hr. PR: Geol. 151, or consent; Undergraduates need consent. Oral and written presentations by students and instructor on selected topics in descriptive, regional, experimental, and theoretical structural geology. (*Offered in Spring of odd years.*)
261. *Stratigraphy and Sedimentation*. II. 3 hr. PR: Geol. 3, 4, 151, 185, or consent. Study of sediments and sedimentary rocks. Field techniques stressed as data gathered and interpreted from rocks of Pennsylvanian age in Morgantown vicinity. Two day field trip required. Basic field equipment and field trips at student's expense.
266. *Appalachian Geology Field Camp*. S. 6 hr. PR: Geol. 151, 185, 261, and consent. Practical experience in detailed geological field procedures and mapping. Living expense in addition to tuition must be paid at time of registration.
270. *Mineral Resources*. II. 3 hr. PR: Geol. 1, 184. Description, mode of occurrence, and principles governing the formation of ore deposits.
272. *Petroleum Geology*. II. 3 hr. PR: Geol. 151. Origin, geologic distribution, methods of exploration and exploitation, uses and future reserves of petroleum and natural gas in the world.
273. *Petroleum Geology Laboratory*. II. 1 hr. PR: Geol. 151. Well sample description, correlation, and interpretation. Construction and interpretation of subsurface maps used in exploration for hydrocarbons.
274. *Coal Geology*. I. 3 hr. PR: Geol. 151, or consent. Introduction to origin, composition, geologic distribution, and exploration of coals.
290. *Geologic Problems*. I, II, S. 1-6 hr. (12 hr. max.). PR: Consent. Special problems for seniors and graduates. Also includes field trips such as Florida Bay carbonate trip.
294. *Introduction to Geochemistry*. II. 4 hr. PR: Chem. 16. Basic review of physical and aqueous chemistry, discussion of the basic geochemical processes; calcium carbonate chemistry, diagenetic processes, weathering, the silicate and iron systems.
315. *Environmental Geoscience*. I. 3 hr. PR: Geol. 1 or consent for non-geology majors. Principles, practice and case histories in application of earth science to environmental problems. Includes: water quality; landslides, subsidence; waste disposal; legal aspects; geologic aspects of land-use planning. Field trips and independent field project required.
329. *Problems and Geomorphology*. I, II. 1-4 hr.
340. *Advanced Stratigraphy*. II. 4 hr. PR: Geol. 231. Study of principles of rock and time correlation, and their application to the stratigraphy of West Virginia.
340. *Advanced Stratigraphy*. I. (Alternate Years.) 3 hr. PR: Geol. 261. Study of the principles of carbonate stratigraphy, including rock and time correlations, carbonate facies through geologic history, and carbonate hydrocarbon reservoirs. Field/laboratory project required. (*Offered in Fall of odd years.*)

341. *Carbonate Sedimentology*. II. 4 hr. PR: Geol. 231 and 261. Origin and distribution of modern marine carbonate sediments as models for interpretation of ancient limestone and dolomite facies complexes. Laboratory experience in thin section petrography of skeletal and non-skeletal carbonate grains, and rock compositions and fabrics.
346. *Advanced Sedimentation*. I. 4 hr. PR: Geol. 261 or consent. Origin of sedimentary rocks; principles involved in interpretation of ancient geography, climates, animals, and plants. Emphasis on detrital sediments and rocks. Required field trips at student's expense.
351. *Tectonics*. II. 3 hr. PR: Geol. 151 or consent. Theories of large deformational processes operating within the earth's crust and upper mantle. Study of the regional structural geology of selected orogens. (*Offered in Spring of even years.*)
353. *Geophysics*. II. 4 hr. PR: Math. 15, Geol. 151, 261 or equiv. Geologic interpretation of geophysical data with emphasis placed on structural and stratigraphic interpretation of seismic records in explorations for hydrocarbon deposits.
357. *Basin Structures*. I. 4 hr. PR: Geol. 151, 261, or equiv. The origin, development, and distribution of basins and the structure found within basins throughout the world are studied. The distribution of energy-related minerals related to basins and structural accumulations are emphasized.
363. *Ground-water Hydrology*. I. 3 hr. PR: Geol. 1 or consent. Study of the principles of ground-water hydrology; occurrence, development, uses, and conservation of ground-water.
364. *Advanced Ground-water Hydrology*. II. 3 hr. PR: Geol. 1, 2, 363 or consent. Review of ground-water exploration, flow, and quality in various geologic terrains. Ground-water pollution and other environmental effects are covered, along with well pumping tests and modeling of ground-water flow.
376. *Coal Petrology*. II. 3 hr. PR: Geol. 274 or consent. Microscopic examination and determination of optical properties of coals, environment of deposition, diagenesis, and metamorphism of coals; coal chemistry and petrography.
385. *Optical Mineralogy and Sedimentary Petrology*. I. 4 hr. PR: Geol. 185 and one year of physics. Principles and practice in use of the petrographic microscope in identification of minerals by the immersion method and thin section; emphasis on sedimentary petrology.
394. *Physical Geochemistry*. I. 3 hr. PR: Geol. 1, 184, 185, Chem. 16. Phase diagrams, metamorphic facies, origin of the elements, chemical properties of ions, crystal chemistry of minerals, element distributions and geochemical cycles. (*Offered in Fall of even years.*)
395. *Aqueous Geochemistry*. II. 3 hr. PR: Geol. 1, Chem. 16 or consent. Review of basic chemical principles as they apply to aqueous geologic environments. Properties of water and the types, sources, and controls of the common and environmentally significant chemical species dissolved in water.
420. *Advanced Topics*. I, II. 1-12 hr. Includes separate courses in karst, advanced hydrology, instrumentation, paleoecology, regional geology, paleobiogeography, advanced coal petrology, and advanced paleontology.
432. *Micropaleontology*. I. 4 hr. PR: Geol. 231. Identification of Foraminifera, Ostracoda, and conodonts; emphasis on classification, nomenclature, and use of paleontological literature. (*Offered in even years.*)
492. *Non-Thesis Research*. I, II. S. 1-12 hr. PR: Consent. Supervised non-thesis research for M.S. Options 2, 3, and 4. Report required by arranged deadline.
497. *Research*. I, II. 1-15 hr.

Geography (Geog.)

201. *Geography of West Virginia*. II. 3 hr. Study of past, present, and future patterns of the physical environment of West Virginia as modified by human activities. To learn the use of geographical information systems for planning in West Virginia.
202. *Political Geography*. 3 hr. Examines the interrelationship between politics and the environment, human territoriality, the political organization of space, geopolitical aspects of the nation-state and international problems.
209. *Industrial Location*. II. 3 hr. PR: Geog. 109 or consent. Applied theoretical aspects of location decisions in primary, secondary, and tertiary activities. Emphasis will be on the understanding of location patterns and the impact of industries on other characteristics of communities.
210. *Urban Geography*. I. 3 hr. An introduction to the geography of the city incorporating consideration of urban systems and city-region linkages, patterns and processes of urban land use, the social geography of the city, and contemporary urban problems.
215. *Population Geography*. 3 hr. Study of the geographic distribution of population and population characteristics including density, age, fertility, morality and settlement patterns. Problems of migration and population/resource issues also will be covered, with an emphasis on developing countries.
219. *Problems in Geography*. I, II. 1-9 hr. PR: Consent. Independent study or special topics.
220. *Seminar in Geography*. I, II. 1-9 hr. per sem.; max. 15 hr. PR: Consent. Includes separate seminars in urban, economic, physical, behavioral, social, Appalachian, transportation, census, planning, resource, international studies, geographic model building, rural problems, cartography, aging and environment, and energy.
225. *Urban Planning Concepts and Techniques*. II. 3 hr. PR: Geog. 210 or Pol. S. 121 or consent. Explores concepts, techniques, and processes of physical and social planning and their application to urban problems including: land use allocation, location of economic activity, housing, transportation, and the delivery of services.
230. *Rural Settlement*. I. 3 hr. Analysis of the form and process of settlement in rural and urban fringe areas. Topics include housing, employment, mobility patterns, service opportunities, and cultural characteristics of rural populations with emphasis on current patterns of change.
235. *The Experience of Space*. II. 3 hr. Explores the individual's changing experience of geographical space over the life cycle as reflected in activity patterns, territoriality, and environmental images. Traces environmental design implications for settings including schools, nursing homes, parks, and shopping malls.
261. *Cartography*. I. 3 hr. An introduction to mapping including historical developments, coordinate systems, projections, generalization, symbolization, map design, computer-assisted cartography, landform representation, and data manipulation for dot, graduate symbol, choropleth, and isarithmic maps.
262. *Cartographic Techniques*. II. 3 hr. PR: Geog. 261 or consent. Advanced map construction including positive and negative artwork, darkroom techniques, color and color proofing, and map reproduction.
285. *Methods of Geographic Research*. I. (Alternate Years.) 3 hr. PR: Consent. Geographic analysis as problem-solving activity. Practical experience in field techniques, library research, hypothesis formation and testing, and report preparation and presentation. Students will acquire skills in literary and numerical approaches to geographic data analysis.
295. *Internship*. I, II, S. 1-12 hr. PR: Junior standing and consent. A working internship with an agency or company designed to give the student experience in the practical application of geographic training to specific problems.

- 299. *Honors Thesis*. I, II, S. 3-6 hr. PR: Departmental consent. Thesis proposal, writing, and defense for students admitted to the Honors program.
- 491. *Advanced Study in Geography*. I, II, S. 1-6 hr. Investigation of topics not covered in regularly scheduled courses. Study may be independent or through scheduled meetings.
- 496. *Graduate Seminar in Geography*. I, II, S. 1-6 hr. Regularly scheduled meetings for discussion of literature and research design related to particular topics in geography.
- 497. *Research in Geography*. I, II, S. 1-6 hr.

HISTORY

Jack L. Hammersmith, *Chairperson of the Department*

202 Woodburn Hall

Degrees Offered: M.A., Ph.D.

Graduate Faculty: Members Bagby, Barns, Connell, Doherty, Donovan, Hammersmith, Hudson, Levine, Maxon, Maxwell, Parkinson, Rosenbaum, Steel, and Williams. Associate Members Arnett, McCluskey, McLeod, O'Brien, and Super.

Master of Arts (M.A.)

Candidates for admission to the master's degree program in history should have had 18 hours of upper-division undergraduate work in history and 9 hours of upper-division undergraduate work in some closely related subject, preferably economics, political science, or sociology and anthropology. A reading knowledge of one foreign language is desirable. Candidates should have a minimum 2.5 overall average in the undergraduate program and a minimum 3.0 overall average in their majors or minors in history.

The Department of History requires that all candidates for the Master of Arts degree in history present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than B.

There are two routes to the master of arts degree in history; a 36-hour degree and a 30-hour degree. The 36-hour degree includes a minimum of 24 semester hours in history. It is possible to include in the 36-hour program a minimum of 9 to 12 hours in one minor representing a closely related discipline in the College of Arts and Sciences. It also is possible that all 36 hours be in the Department of History. The candidate for the 36-hour master's will be required to pass a final oral comprehensive examination covering the candidate's graduate course work.

The 30-hour degree consists of 24 hours of course work in history and incorporate a thesis for which 6 hours credit may be allowed. The candidate for the 30-hour master's will be required to pass a final oral comprehensive examination covering the graduate course work and the thesis.

Doctor of Philosophy (Ph.D.)

Requirements for the Ph.D. degree in history include the general requirements of the Graduate School; a reading knowledge of two foreign languages approved by the Department; passing the Ph.D. comprehensive examination of two parts (oral and written) administered by a committee of faculty members (normally at the end of a full-time student's second year of study); preparation of

an acceptable dissertation based upon original investigation, and successful defense of the dissertation in a final examination.

A candidate must offer a program of study in four fields, at least three of which must be in history; the other may be in a related field approved by the department. The Department of History requires that all candidates for the doctor's degree present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than B. Students shall offer four sub-fields, at least two of which must be in one general field:

1. European Medieval; Early Modern (1400-1789); Recent (1789-present).
2. American to 1865; Since 1850.
3. English 1066-1660; 1660-Present.
4. Third World Africa; Asia; Latin America.
5. Field in Another Department.

Selection of a field of concentration does not necessarily mean a selection of the dissertation field.

Program in the History of Science and Technology

The College of Arts and Sciences and the Department of History recently inaugurated a program in the history of science and technology. Graduate research assistantships have been established for students affiliated with the program and graduate-level instruction is available. Further information is available at the Department of History office.

History (Hist.)

200. *Greece and Rome*. 3 hr. Covers the Minoan and Mycenaean civilizations, Archaic and Classical Greece, Alexander the Great and the Hellenistic Age, the Roman Republic, and Etruscan and Carthaginian states, and the rise of the Roman Empire.
201. *Social and Economic History of the Middle Ages, 300-1000*. 3 hr. Topics include the social-economic crisis of the late Roman and German institutions, the Merovingian and Carolingian economics, Pirenne Thesis, and transition to feudal society. Hist. 103 recommended as preparation. (Course will not be offered in 1981-1982.)
202. *Social and Economic History of the Middle Ages, 1000-1500*. 3 hr. Topics include feudal society, land and population expansion, fairs, towns, leagues, Italian leadership, crusades, church influence, black death, fourteenth century revolts, and general decline of late Middle Ages. Hist. 103, 201 recommended as preparation.
204. *Ancient and Medieval Science. I*. 3 hr. Examination of scientific achievements from ancient myths to medieval philosophies of nature. Stresses the internal coherence of the approaches to nature taken by various cultures. No scientific background is assumed.
205. *The Renaissance*. 3 hr. Survey of the underlying political, economic, and social structure of fourteenth and fifteenth century Italy with concentration on the significant intellectual and cultural trends which characterized the age. Some consideration given to the problem of the impact of the early Reformation movement upon Renaissance culture.
206. *The Reformation*. 3 hr. The distinguishing theological characteristics of the major Reformation movements with concentration on the effect of religious-intellectual crisis on the political and social structure of the sixteenth century.
207. *Early European Science and Culture*. 3 hr. Examination of European intellectual history from the Renaissance to the early eighteenth century with particular atten-

tion being paid to contribution of Copernicus, Bacon, Descartes, Kepler, Galileo, and Newton.

208. *Science and Society, 1750-1914*. 3 hr. Historical examination of the relationship between science and technology with particular attention being paid to the doctrines of Positivism, Darwinism, and Scientific Socialism.
209. *The ABC Powers of Latin America*. 3 hr. Detailed course of the political events and of the economic and cultural institutions of Argentina, Brazil, and Chile from the dawn of independence to the present day.
210. *Modern Spain*. 3 hr. Survey of Spanish political, economic, and cultural developments from national unification under Ferdinand and Isabella to Francisco Franco. Includes Portuguese history from 1580 to 1640.
211. *Technology in the Industrial Revolution. I*. 3 hr. Technological and social change in Great Britain and United States. Case studies illustrating the nature of technological development and providing an understanding of the ways in which technology has shaped human experience.
213. *Bourbon France*. 3 hr. French history from the reign of Henry IV to the reign of Louis XVI. Special attention given to the reigns of Louis XIII and Louis XIV. Political, cultural, and intellectual history emphasized.
214. *The Revolutionary-Napoleonic Era*. 3 hr. French history from mid-eighteenth century to 1815. Special attention given to the background of the French Revolution of 1789, to the political and social history of the revolution, and to Napoleon's non-military achievements.
215. *European Diplomatic History, 1815 to 1919*. 3 hr. Designed to develop an understanding of the forces, men, and events which determined diplomatic relations between the major powers.
216. *European Diplomatic History, 1919 to Present*. 3 hr. Scope similar to that of Hist. 215.
217. *Diplomatic History of the U.S.S.R., 1917 to 1939*. 3 hr. Detailed study of Soviet diplomatic history, with emphasis on the view from the Kremlin balanced by the responses of other powers. Understanding of European diplomatic history desirable.
218. *Diplomatic History of the U.S.S.R., 1939 to Present*. 3 hr. Scope similar to that of Hist. 217.
222. *Twentieth-Century Germany from Weimar to Bonn*. 3 hr. The Weimar Republic, the Third Reich, and the two German states created after World War II.
225. *History of Modern China*. 3 hr. Introduction to modern China (since 1839) with some attention to China's Confucian heritage; examines in detail the Chinese effort to modernize in the face of Western diplomatic and economic pressure; specific attention to China's Nationalist and Communist revolutionary traditions.
226. *History of Modern Japan*. 3 hr. Introduction to modern Japan (since 1868) with some attention to the development of Japanese institutions and ideas in earlier periods, especially the Tokugawa Era (1600-1868); examines the rapid pace of economic change in the nineteenth and twentieth centuries along with the important social, political, and diplomatic implications of this change.
227. *East Africa to 1895*. 3 hr. History of East Africa from earliest man to beginning of European control. Population movement and interaction, development of varying types of polity, revolutionary changes, and European scramble for East Africa form major focus.
228. *East Africa Since 1895*. 3 hr. History of colonial rule and movement to independence in East Africa. Political, economic, and social changes will be examined with par-

particular emphasis on rise and triumph of African nationalism. (Course will not be offered in 1981-82.)

229. *History of Africa: Pre-Colonial*. 3 hr. History of Africa from earliest man to the middle of the nineteenth century. Particular emphasis on population movement and interaction, state formation, and the development of trade in sub-saharan Africa as well as the impact of such external influences as Christianity and Islam.
230. *History of Africa: European Dominance to Independence*. 3 hr. History of Africa from the middle of the nineteenth century to the 1960's. In the first half of the course, the establishment and functioning of European colonial regimes in African history, and recent interpretations in the field.
231. *Seventeenth Century Britain, 1603-1715*. 3 hr. The more significant political, social, economic, religious, and intellectual developments of Britain during a century of revolution and of the men and women who interacted with those movements. (Course will not be offered in 1981-82.)
232. *Eighteenth Century Britain, 1715-1832*. 3 hr. The "Age of Aristocracy," the political, social, religious, economic, and intellectual forces which produced it, and the reasons for its decline under the combined impact of the Industrial, Agricultural, American, and French revolutions. (Course will not be offered in 1981-82.)
241. *English Social History, Fourteenth to Eighteenth Century*. 3 hr. Topical examinations of English society from the time of Chaucer to Milton. Major topics: society in town and country, economy, politics, religion, and thought.
242. *English Social History, Eighteenth Century to the Present*. 3 hr. Topical examination of English society from the time of Queen Anne to the present.
251. *History of Black People in America to 1900*. 3 hr. Consideration given to slave trade and evolution of slavery in the New World, the attack upon slavery and its destruction, the South and the Negro during Reconstruction, and the age of Reaction and Racism, 1875-1900.
252. *History of Black People in America Since 1900*. 3 hr. Consideration given to race conflict and black migration, the blacks in American world wars, desegregation practices both in the South and the North, and trends toward black nationalism.
253. *Civil War and Reconstruction*. 3 hr. Study of the causes as well as the constitutional and diplomatic aspects of the Civil War; the role of the American Negro in slavery, in war, and in freedom; and the economic and political aspects of Congressional Reconstruction.
255. *The Cleveland Era*. 3 hr. The "Gilded Age," with emphasis on the political and social impacts of urban-industrial growth. Growth of large cities and a national communications network, the rise of the corporation, the subordination of regional interests and racial minorities, political protest movements and changes in the structure and sociology of politics, with special attention to the Congress and the Presidency.
257. *The United States From McKinley to the New Deal, 1896 to 1933*. 3 hr. American national history from William McKinley to Franklin D. Roosevelt. Particular attention given to the great changes in American life after 1896; national political, economic, social, and cultural development; the Progressive Era in American politics; and alterations in American foreign relations resulting from the Spanish-American War and World War I.
259. *Recent American History, 1933 to Present*. 3 hr. Detailed study of American national history from the inauguration of Franklin D. Roosevelt to the present. Emphasis on the New Deal; on Roosevelt's foreign policies and their impact on American social, technological, and cultural developments; and on United States domestic problems and foreign relations since 1945.

261. *Economic and Social Development of West Virginia*. 3 hr. Study, primarily regional in nature, of the economic, social, technological, cultural, and religious history of West Virginia.
263. *American Diplomacy to 1918*. 3 hr. American foreign policy and diplomacy from the adoption of the Constitution to the end of World War I. Assumes some student knowledge of the period such as that obtained in Hist. 52 and 53.
264. *American Foreign Policy and Diplomacy, 1918 to the Present*. 3 hr. America's foreign policy and growing involvement in international relations including our role in World War II, the Korean War, and Vietnam. Assumes that the student has some knowledge of the period such as that obtained in Hist. 2, 53, or 161.
266. *American Economic History to 1865*. 3 hr. Origins and development of American business, agricultural, and labor institutions, problems, and policies, from 1600 to 1865; influence of economic factors upon American history during this period.
267. *American Economic History Since 1865*. 3 hr. Covers 1865 to the present. Scope similar to that stated for Hist. 266. (Course will not be offered in 1981-82.)
268. *The Old South*. 3 hr. History of the South — exploring the peculiar differences that led to an attempt to establish a separate nation. The geographical limitation permits a detailed study of economic and social forces within the context of the larger national history. (For advanced undergraduates and graduates.)
269. *The New South*. 3 hr. Integration of the South into the nation after Civil War. Emphasis on southern attitudes toward industrialization, commercial agriculture, organized labor, and the Negro. Special attention to the southern literary renaissance and conservative and progressive politics of the southern people.
271. *The American Frontier East of the Mississippi*. 3 hr. Westward expansion from discovery of America to Louisiana Purchase. Emphasis on frontier section in the region from the Tidewater to the Mississippi Valley. (Course will not be offered in 1981-82.)
272. *The American Frontier West of the Mississippi*. 3 hr. Westward expansion from the Louisiana Purchase to the passing of the frontier in 1893. Original investigation and reassessment of a number of controversial problems. (Course will not be offered in 1981-82.)
273. *The City in American History I*. 3 hr. The Era of Commerce, 1630-1895; concerning the settlement, design, and growth of North American commercial and administrative centers particularly transportation development and the role of urban elites in shaping national economic policies.
274. *The City in American History II*. 3 hr. The Industrial Age, 1820-present; focusing on the interaction of industrialization and urbanization during the nineteenth and twentieth centuries particularly the impact of technology upon urban life and the role of cities in national politics.
301. *Readings in Medieval History*. 3-6 hr. Crusades and intellectual history are the focus. Readings in preparation for medieval field may be selected by graduates. Hist. 103 urged strongly for undergraduates; also reading knowledge of Latin, French or German recommended for all. (Course will not be offered in 1981-82.)
305. *Readings in English History*. 3-6 hr. Directed readings of scholarly books and articles, primarily in the history of England from about 1450 to about 1625 but with some opportunity for the student to fill gaps in the student's knowledge of other periods of English history.
309. *Readings in Central European History*. 3-6 hr. All students will read and discuss selected works illustrating outstanding scholarship or interpretative problems related to fifteenth, sixteenth, and early seventeenth century history. In addition

opportunity will be provided for each student to pursue an independent reading project tailored to the student's special interests.

313. *Readings in Eastern European History.* 3-6 hr. For the student who desires to read on a specific topic in Russia or Soviet history. Materials selected will be primarily in the most scholarly studies available in English.
317. *Readings in Western European History.* 3-6 hr. This course, primarily for graduate students and selected undergraduates, is designed for an intensive reading program on special problems in western European history. (*Course will not be offered in 1981-82.*)
321. *Reading in Asian History.* 3-6 hr. Intensive readings in the history of East Asia (especially China and Japan) since the nineteenth century; students should normally have had Hist. 225 and 226 or their equivalents; reviews as well as bibliographical and historiographical essays required. (*Course will not be offered in 1981-82.*)
325. *Readings in African History.* 3-6 hr. This course will normally focus on readings and discussion on problems in the history of pre-colonial Africa, the major works in African history, and recent interpretations in the field. (*Course will not be offered in 1981-82.*)
351. *Readings in American History, 1492-1789.* 3-6 hr. A course of supervised readings and reports designed to prepare students for intensive study in a seminar or for field examinations in the colonial period of American history. Students are expected to acquire comprehensive and detailed bibliographical knowledge. (*Course will not be offered in 1981-82.*)
355. *Readings in American History, 1763-1865.* 3-6 hr. A course of supervised reading and reports designed to prepare students for intensive study in a seminar or for field examinations in the early national period. Students are expected to acquire comprehensive and detailed bibliographical knowledge.
359. *Readings in American History, 1850-1898.* 3-6 hr. A survey of the narrative and interpretative literature of the Civil War, Reconstruction, and the Gilded Age. Students will be expected to make weekly or bi-weekly reports on assigned readings and also to prepare a critical essay on some aspect of American historiography for this period.
363. *Readings in American History, 1898 to Present.* 3-6 hr. Readings and class-led discussion of one paper-back book per week, and preparation of a paper based on these books and the class discussion of them. Usually concentrates on post World War II foreign relations.
367. *Readings in Frontier History.* 3-6 hr. A detailed course of readings of sources and significant secondary works in frontier literature. (*Course will not be offered in 1981-82.*)
373. *Readings in Local and Regional History.* 3-6 hr. A course for graduate students and seniors in the history of West Virginia and neighboring states, which form what is known as the Trans-Allegheny or Upper Ohio region.
375. *Readings in Science and Technology.* 3-6 hr. Directed reading of scholarly books and articles dealing with selected topics in the history of science and technology.
377. *European Cultural and Intellectual History. (300-1000 A.D.)* 3 hr. Topical approach including the development of early Christian thought, the conflict of pagan and Christian thought, the Latin Church Fathers, Boethius, Irish, and Anglo-Saxon culture, the Carolingian Renaissance. Hist. 103 recommended, as well as reading knowledge of Latin, French, or German. (*Course will not be offered in 1981-82.*)
378. *European Cultural and Intellectual History. (1000-1500).* 3 hr. Topics include Cathedral Schools, Renaissance of twelfth century, Arab influence on Western thought,

Scholasticism, post-Thomistic reaction, and developing political theory. Hist. 103, 301 plus reading knowledge of Latin, French, German or Italian are all recommended.

381. *Intellectual and Social History of the United States to 1876.* 3 hr. The objective of the course is to establish for graduate students usable frames of reference for intellectual and social history. The basic premises of various historians are examined as they have been applied to the history of the United States before 1876.
382. *Intellectual and Social History of the United States Since 1876.* 3 hr. A continuation of Hist. 381, with the same objective of establishing usable frames of reference for intellectual and social history, with the focus on the history of the United States since 1876. Special attention is devoted to the problems of very recent or contemporary history.
391. *The American Labor Movement.* 3 hr. A readings course which emphasizes the various labor unions and labor's political activities in the United States from the eighteenth century to 1960. Careful attention is given to the economic and social conditions that have shaped the history of labor in this country. The course treats the story of American labor as an integral part of the history of the United States. (Course will not be offered in 1981-82.)
392. *History of American Agriculture.* 3 hr. A readings course to acquaint students with the origins and evolution of American agriculture, with particular emphasis upon scientific, technological, and economic development; to familiarize them with some public and private agricultural organizations; and to give them an historical understanding of contemporary agricultural problems and policies.
402. *Seminar in Medieval History.* 3 hr. Crusades and intellectual history of Europe in the Middle Ages with emphasis on the period from 1000 to 1300. Prerequisites: History 301 and reading knowledge of Latin plus French or German or Italian. (Course will not be offered in 1981-82.)
406. *Seminar in English History.* 3 hr. Directed research in selected topics in the history of England from about 1450 to about 1625. Training in bibliography, research methods, and paleography.
410. *Seminar in Central European History.* 3 hr. An intensive survey of the bibliographical aids and printed source materials available in the field of Reformation history. A research paper and a bibliographical essay will be presented by each student. Reading knowledge of German and French strongly recommended. (Course will not be offered in 1981-82.)
414. *Seminar in Eastern European History.* 3 hr. Selected topics in nineteenth or twentieth century Russian/Soviet diplomatic or political history. Research paper required.
418. *Seminar in Western European History.* 3 hr. A research seminar in selected topics in western European history. Requirements: examinations, problem papers, research papers, and extensive reading. A reading knowledge of the appropriate languages is also required. (Course will not be offered in 1981-82.)
422. *Seminar in Asian History.* 3 hr. Advanced readings and research in East Asian history; specific emphasis on research tools and techniques; research paper based on English-language sources required; students should normally have had Hist. 225 and 226 or their equivalents. (Course will not be offered in 1981-82.)
426. *Seminar in African History.* 3 hr. The seminar will normally focus on Eastern Africa in the colonial period. Location and use of source materials will be emphasized as well as economic and political developments. Students will spend considerable time in research and writing on selected aspects of Eastern African history.

441. *Seminar in Latin American History*. I, II. 3 hr. PR: Consent. Survey of Latin American historiography, location and use of primary source materials, discussion of research techniques, and the writing of a research paper. Reading knowledge of Spanish, Portuguese, or French will be helpful. (Course will not be offered in 1981-82.)
452. *Seminar in American History, 1492-1789*. 3 hr. Students work together and with the instructor on the historical materials of the era, confronting the problems and learning the techniques for using different kinds of original materials. Periodic progress reports are required at each meeting and one major paper, derived primarily from the original materials being used.
456. *Seminar in American History, 1763-1865*. 3 hr. Students work together and with the instructor on historical materials of the era, confronting the problems and learning the techniques for using different kinds of original materials. Periodic progress reports required at each meeting and one major paper, derived primarily from the original materials being used.
460. *Seminar in American History, 1850-1898*. 3 hr. Directed research in recent American history including guidance in method of research and manuscript preparation.
464. *Seminar in American History, 1898 to Present*. 3 hr. Directed research in recent American history including guidance in method of research and manuscript preparation. (Course will not be offered in 1981-82.)
468. *Seminar in Frontier History*. 3 hr. Intensive study of selected frontier problems. Requirements: detailed outside reading and a term paper on some original topic based on sources and secondary works. (Course will not be offered in 1981-82.)
474. *Seminar in Local and Regional History*. 3 hr. A seminar for graduate students in the history of West Virginia and neighboring states, which form what is known as the Trans-Allegheny or Upper Ohio region.
475. *Seminar in Science and Technology*. II. 3 hr. PR: Hist. 375. Directed research in selected topics in the history of science and technology.
477. *American Historiography*. 3 hr. A review of the major American historians and biographers and their interpretative studies. The nationalism, imperial, frontier, sectional, social and intellectual schools of history are studied as well as those historians who have concerned themselves with the problems of writing history.
478. *European Historiography*. 3 hr. Readings of selected works representative of each of the following historical periods: Ancient, Medieval, Renaissance-Reformation, Early Modern, and Modern. Reports required with attention to style, purpose, philosophy, and methodology of the historians selected. Attention to trends, major breakthroughs, and classics in the writing of European history. Reading knowledge of Greek, Latin, French, German, or Italian an asset. (Course will not be offered in 1981-82.)
- 481, 482. *Special Problems*. 1-3 hr. ea.
490. *Teaching Practicum*. 1-3 hr. PR: Consent. Supervised practices in college teaching of history. (Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibilities.)
493. *Folger Institute Seminar*. I, II. 3 hr. PR: Graduate standing. Seminar conducted by distinguished scholars and held at the Folger Institute of Renaissance and Eighteenth Century Studies in Washington, D.C. Topics vary. (Enrollment is by special application only. Contact department chairperson for information.) (Also listed as Engl. 493.)
497. *Research*. 1-15 hr.

HORTICULTURE

Morris Ingle, In Charge of the Graduate Program in Horticulture

G-164 Agricultural Sciences Building

Degree Offered: M.S.

Graduate Faculty: Members Bearce, Ingle, Neal, and Schubert. Associate Members Blizzard and Singha.

Graduate studies in Horticulture leading to the M.S. degree are based on the biological and physiological sciences. Students entering the program must have an adequate background in agriculture, biology, and chemistry. Deficiencies in these areas must be corrected early in a student's program by enrollment in specified courses.

Faculty and facilities are available for thesis research in weed science, plant propagation, greenhouse management, ornamental production, tree and small fruit production, and fruit physiology and storage. A thesis is required. Graduates are employed by private industry, governmental agencies, and educational institutions, or become self employed. Horticulture students interested in studying for the Ph.D. degree enroll in the Crop Science option of Agronomy.

Horticulture (Hort.)

- 204. *Plant Propagation*. II. 3 hr. PR: Pl. Sc. 52. Study of practices of plant propagation and factors involved in reproduction in plants. (*Offered in Spring of even years.*)
- 242. *Small-Fruits*. I. 3 hr. (2 lec., 1 scheduled lab.). PR: Pl. Sc. 52, Hort. 107, or consent. Taxonomic, physiological, and ecological principles involved in production and handling of small-fruits. (*Offered in Fall of even years.*)
- 243. *Physiology of Vegetables*. I. 3 hr. (2 lec., 1 scheduled lab.). PR: Pl. Sc. 52. Physiological and ecological principles involved in production of vegetable crops. (*One 3-day field trip required.*) (*Offered in Fall of even years.*)
- 244. *Handling and Storage of Horticultural Crops*. I. 3 hr. (2 lec., 1 scheduled lab.) PR: Pl. Sc. 52, Chem. 16. Characteristics of perishable crops. Methods and materials used to maintain quality. (*Offered in Fall of odd years.*)
- 245. *Greenhouse Management*. II. 3 hr. PR: Two semesters of Inorganic Chemistry and Hort. 107 or consent. Greenhouse as a controlled plant environment. How to manipulate factors influencing plant growth and development within specialized environments of greenhouses.
- 246. *Tree Fruits*. I. (Alternate years.) 3 hr. (2 lec., 1 scheduled lab.). PR: Pl. Sc. 52 or consent. Principles and practices involved in production of tree fruits. (*Offered in Fall of even years.*)
- 301. *Post-Harvest Physiology*. II. 3 hr. (1 lec., 2 labs.). Physiology and biochemistry of harvested crops. (*Offered in Spring of odd years.*)

Plant Science (Pl. Sc.)

- 200. *Recognition and Diagnosis of Plant Disorders*. I. 4 hr. PR: P. Pth. 201 and Ento. 204. Creates an ability for the student to use systematic inspection to determine cause or causes of a plant disorder.
- 201. *Principles and Methods of Plant Pest Control*. II. 4 hr. PR: P. Pth. 201 and Ento. 204. Concepts of control and how they are implemented by exclusion, eradication, protection, and immunization.

- 420. *Special Topics*. I, II, S. 2-6 hr. Special study in agricultural microbiology, crop science, entomology, horticulture, plant pathology, or soil science.
- 450. *Seminar*. I, II, 1 hr. Graduate seminar in agricultural microbiology, crop science, horticulture, plant pathology, or soil science.
- 497. *Research*. I, II, S. 1-15 hr. Graduate research in agricultural microbiology, crop science, horticulture, plant pathology, or soil science.

INDUSTRIAL ENGINEERING

Thomas P. Cullinane, *Chairperson of the Department*

727 Engineering Sciences Building

Degrees Offered: M.S.I.E., M.S.E., M.S., Ph.D.

Graduate Faculty: Members Byrd, Cullinane, Elias, Gochenour, Mallik, Moore, Plummer, Tompkins, and Ward. Associate Members Creese, Denny, Fowler, Iskander, and Stobbe.

The Department of Industrial Engineering believes that graduate study, at all levels, must be centered around experience in the area of research selected by the student. In this context the department emphasizes involvement of graduate students with people and organizations that have industrial engineering oriented problems needing attention and solution. Applied research devoted to solving real problems and experimental research which may be more developmental in nature are equally valued. Ours is not a "worry tower" environment.

Master of Science in Industrial Engineering (M.S.I.E.)

Master of Science in Engineering (M.S.E.)

Master of Science (M.S.)

At the master's level, three degrees are offered: M.S.I.E., M.S.E., and M.S. with an emphasis in Environmental/Occupational Health Studies. The M.S.I.E. degree program is appropriate for students with a B.S. in Industrial Engineering, whereas the M.S.E. degree program is designed for students possessing a baccalaureate degree in a technical field other than industrial engineering who wish to pursue a broader, more interdisciplinary program of graduate studies in such areas as manufacturing systems, management systems engineering, and ergonomics. A description and listing of requirements for the M.S. Degree in the field of Environmental/Occupational Health Studies, which is administered by the Department of Industrial Engineering, are presented elsewhere in Part 4 of the *Graduate School Catalog*.

An undergraduate degree in either another engineering field or the basic sciences is required for admission to both the M.S.E. and M.S. programs. Students trained in the areas of mathematics, statistics, physics, and computer science are generally well prepared for graduate study with an emphasis in operations research techniques, while many chemistry and biology majors will find excellent career opportunities in the field of occupational safety and health. The M.S. program is designed specifically for this latter group of students.

Students must comply with the rules and regulations as outlined in Part 3 of this *Catalog* for graduate work in the College of Engineering. Each master's candidate must follow a planned program of study which contains a minimum of 30 semester credit hours, including either a thesis of not more than 6 hours of research, or a problem report of not more than 3 hours of work.

Required courses for the M.S.I.E. are I.E. 284 (Simulation), I.E. 314 (Design of Experiments), and I.E. 377 (Advanced Engineering Economy). Required courses for the M.S.E. are I.E. 214 (Analysis of Engineering Data), I.E. 284, and I.E. 377. The M.S. in Environmental/Occupational Health Studies course requirements are listed elsewhere in Part 4 of the *Graduate School Catalog*. Specific requirements may be obtained by writing to the department.

As a general rule, each student must satisfy the listed prerequisites for each course included in his/her graduate plan of study. Prerequisite deficiencies are usually made up by taking the necessary prerequisite courses, which will be included in the plan of study, but normally not counted for credit toward the master's degree. However, certain prerequisite courses can be taken by examination if an entering student has an undergraduate grade-point average of 3.0 or better.

While required credit in research (I.E. 497) is devoted to a problem report or thesis preparation, neither is automatically approved after the required number of semester hours of research work have been completed. The thesis or problem report must conform with the general requirements of the Graduate School and with the written requirements of the Department of Industrial Engineering.

Final Examination. A candidate will be required to pass an oral examination on course work and the thesis or problem report.

Doctor of Philosophy (Ph.D.)

A candidate for the degree of Doctor of Philosophy (Ph.D.) must comply with the rules and regulations of the College of Engineering and the Graduate School. A program with a major in industrial engineering, designed to meet the needs and objectives of each student, will be developed in consultation with the student's adviser and the student's Advisory and Examining Committee. Early in the doctoral program the student will be required to demonstrate master's-level proficiency in industrial engineering subject matter. Upon completion of the course work, the student must pass a comprehensive examination to be admitted to candidacy. An acceptable dissertation must be written.

In recent years, students in the program have pursued research topics in the area of mathematical modeling applied to such fields as manufacturing systems, public transportation systems and energy management. More recent areas of emphasis are ergonomics and safety engineering. The department remains dedicated to providing opportunities in all of these areas in the future.

Industrial Engineering (I.E.)

- 213. *Engineering Statistics.* 3 hr. PR or Conc.: Math. 17 or consent. Sample spaces and probability. Normal, binomial, Poisson, and other distributions with engineering applications. Measures of central tendency and dispersion. Tests of significance and confidence intervals. Introduction to analysis of variance and regression analysis. Engineering applications emphasized throughout.
- 214. *Analysis of Engineering Data.* 3 hr. PR: I.E. 213. Introduction to linear statistical models. Design and analysis of simpler experimental configurations occurring frequently in engineering studies. Similarities and differences between regression and experimental design models emphasized in a vector-matrix setting.
- 215. *Statistical Decision Making.* 3 hr. PR or Conc.: I.E. 213. Basic concepts of probability theory. Discrete and continuous distributions, joint and derived distributions,

with application to industrial and research problems. Introduction to generating functions and Markov chains. (*Course will not be offered in 1981-82.*)

216. *Industrial Quality Control*. 3 hr. PR: I.E. 213. Principles and methods for controlling the quality of manufactured products, with emphasis on both economic and statistical aspects of product acceptance and process control.
222. *Job Evaluation and Wage Incentives*. 3 hr. PR: I.E. 140 or consent. Principles used in evaluating jobs, rates of pay, characteristics and objectives of wage incentive plans; incentive formulae and curves.
242. *Production Planning and Control*. 3 hr. PR: I.E. 140; Conc.: I.E. 214. Principles and problems in forecasting, aggregate planning, material management, scheduling, routing, and line balancing.
243. *Facility Planning and Design*. 3 hr. PR: I.E. 242, 250. Problems of facility and equipment location. Long-range planning of industrial facilities. Block and detailed layout of manufacturing plants and general offices. Space utilization and applied topics in facility design.
249. *Design of Dynamic Materials Systems*. 3 hr. PR: I.E. 140 or consent. Application of industrial engineering theory and practice to selection of material systems and equipment including efficient handling of materials from first movement of raw materials to final movement of finished product. Present quantitative design techniques.
250. *Introduction to Operations Research*. 3 hr. PR: I.E. 213, 281. Basic tools and philosophies of operations research. Tools include: linear programming, Markov chains, queueing theory and simulation. Other operations research techniques are presented as they relate to the overall systems philosophy.
251. *Analytical Techniques of Operations Research*. 3 hr. PR: I.E. 213 or consent. Survey of nonlinear optimization techniques useful in operations research and industrial engineering studies. Includes classical optimization techniques, quadratic, geometric and dynamic programming, branch and bound and gradient techniques. (*Course will not be offered in 1981-82.*)
259. *Introduction to Systems Engineering*. 3 hr. PR: I.E. 250, or consent. Quantitative synthesis of OR models. Definition of terms. Development and testing of assumptions, objectives, and restrictions. Measurement of parameters in the model. Optimization techniques and error sensitivity of the optimal solution. Implementing, utilizing, and upgrading the model. (*Course will not be offered in 1981-82.*)
260. *Human Factors Engineering*. I, II. 3 hr. PR: I.E. 213 or equiv. Includes the study of ambient environment, human capabilities and equipment design. Systems design for the man-machine environment interfaces will be studied with emphasis on health, safety, and productivity.
261. *System Safety Engineering*. I. 3 hr. PR: Consent. The concepts of hazard recognition, evaluation analysis and the application of engineering design principles to the control of industrial hazards.
277. *Engineering Economy*. 3 hr. PR: Junior standing. Derivation of compound interest formulas and using them as a tool of decision making. Comparison of various alternatives based on annual costs, present worth, rate of return, benefit-cost ratio before and after income taxes. Depreciation methods, sensitivity analysis, sunk costs, increment costs, retirement, and replacement.
280. *Industrial Engineering Problems*. 1-3 hr. PR: Consent. Special problems.
281. *Digital Computation for Engineers*. 3 hr. Conc.: Math. 16. Introduction to FORTRAN programming for engineering students. Emphasis on development of skills in problem definition and coding. Class projects will be chosen to illustrate selected numerical and non-numerical processing methods.

282. *Digital Computer Concepts*. 3 hr. PR: I.E. 281 or consent. Principles of digital computer functional components. Study of digital operating systems including structure of the various subsystem components such as monitors, input control systems, and loaders. (Course will not be offered in 1981-82.)
283. *Information Retrieval*. 3 hr. PR: I.E. 281 or consent. Tools, elements, and theories of information storage and retrieval. Documentation, information framework; indexing; elements of usage, organization and equipment; parameters and implementation; theories of file organization and system design. (Course will not be offered in 1981-82.)
284. *Simulation by Digital Methods*. 3 hr. PR: I.E. 213, 281, or consent. Introduction to Monte Carlo simulation methods and their application to decision problems. Student identifies constraints on problems, collects data for modeling, and develops computer programs to simulate and analyze practical situations. Interpretation of results emphasized.
291. *Design of Production Systems I*. 3 hr. PR: Senior standing in industrial engineering. The integration of industrial engineering principles in the design of productive systems. Emphasis will be on the analysis of different systems for productivity improvement.
292. *Design of Productive Systems II*. 3 hr. PR: Senior standing in industrial engineering. Continuation of I.E. 291.
300. *Special Topics in Manufacturing Processes and Automation*. 3 hr. PR: I.E. 100 or equiv. Special topics concerning manufacturing processes and automation with special emphasis on manufacturing management.
314. *Design of Industrial Experiments*. 3 hr. PR: I.E. 214 or consent. Continuation of I.E. 214. Study of more complex experimental design especially useful to engineering and industrial researchers, including factorials and optimum-seeking design. Emphasis on use of existing digital computer routines and interpretation of results.
325. *Engineering Management*. 3 hr. A study of the unique problems of engineering organizations including project planning, managing creativity, coordinating design and development, and other topics relevant to engineering organizations.
338. *Technology Forecasting*. 3 hr. A study of the various procedures used in forecasting technical developments.
339. *Technology Assessment*. 3 hr. A study of the various procedures used in technology assessment. The implications of technology in various aspects of society will be stressed. (Course will not be offered in 1981-82.)
340. *Fundamentals of Traditional Industrial Engineering*. 3 hr. Basic fundamentals of traditional industrial engineering including methods studies and improvement methods and activity analysis charts, work measurement, job evaluation, plant layout, and materials handling principles. (Course will not be offered in 1981-82.)
341. *Methods Analysis and Work Simplification*. 3 hr. Advanced study of the techniques of methods analysis, including modern means of methods research. Development of appropriate cost analysis to accompany improved operating plans. A study of the design, installation, and administration of work simplification programs, suggestion systems, and remuneration policies, and the means of intra-plant communications concerning such programs, 2 hr. rec., 3 hr. lab. (Course will not be offered in 1981-82.)
342. *Advanced Production Control*. 3 hr. PR: I.E. 250. Different mathematical models useful in the design of effective production control systems. The various models to be covered include: static production control models under risk, and uncertainty, dynamic models under certainty, under uncertainty, and under risk.

353. *Applied Linear Programming*. 3 hr. PR: I.E. 250 or consent. Application of the assignment, transportation, and simplex algorithms to typical industrial problems. The methods and computational efficiencies of the revised simplex and other algorithms are also studied.
354. *Case Studies in Operations Research*. 3 hr. PR: Consent. This course will examine the applications of operations research procedures in a variety of applications. The course objective is to examine the factors which lead to successful model building through case studies.
355. *Scheduling and Sequencing Methods*. 3 hr. PR: I.E. 250. Theory and application of analytical models used in the scheduling of operations. Topics include single machine scheduling models, flow shop models, job shop models, and assembly line balancing methods.
358. *Special Topics in Systems Analysis and Operations Research*. 3-6 hr. PR: Consent. Special topics from recent developments in operations research and related fields. Special emphasis will be placed on interests of current graduate students.
359. *Operations Research for Public Administrators*. 3 hr. Examination of role of quantitative analysis in public administration and decision-making.
360. *Human Factors System Design*. 3 hr. PR: I.E. 260 or consent. Theoretical aspects and practical applications of man/machine relationships as they influence future system design. The student will examine human limitations with respect to acceptance of information, decision making, and ability to transmit the result of such decisions to controlled equipment systems to obtain design optimization. 2 hr. rec., 3 hr. lab.
361. *Industrial Hygiene Engineering*. 3 hr. PR: Consent. The recognition of environmental stresses present in man-machine systems and the effect of these stresses on health, safety, and performance of man. Calibration procedures, proper sampling, and field survey techniques will be stressed.
368. *Advanced Problems in Human Factors*. 1-3 hr. PR: I.E. 260 or 360 and graduate standing. Special problems relating to one of the areas of human factors, such as simulation, controls, vigilance, safety, and occupational health.
377. *Advanced Engineering Economy*. 3 hr. Special emphasis on depreciation, engineering and economic aspects of selection and replacement of equipment; relationship of technical economy to income taxation, effect of borrowed capital and pricing model.
381. *Integrated Data Processing*. 3 hr. PR: I.E. 281 and consent. Advanced work in electronic data-processing systems and procedures design. Case studies of integrated data-processing systems. Course projects will include individual use of a computer in management data-processing analysis problems.
385. *Digital Computer Applications*. 1 hr. PR: Senior standing in engineering, physical science or mathematics. Special study of selected programming languages.
389. *Special Topics in Industrial Data Processing Systems*. 3 hr. PR: I.E. 281 or consent. Selected topics relating to industrial applications of computer and data processing systems. Emphasis on applications not in the FORTRAN language.
431. *Traffic Flow Theory*. 3 hr. PR: I.E. 213 and C.E. 439 or consent. Hydrodynamics, car-following, and queueing theory models of traffic flow. Emphasis on the application of probability theory models to traffic situations.
451. *Nonlinear Programming*. 3 hr. PR: I.E. 250 or consent. Advanced study of the techniques of nonlinear programming and their applications. Topics covered include steepest descent, Newton's method, Fletcher-Powell, conjugate gradients, Powell's method, and penalty function methods.

452. *Queueing Theory*. 3 hr. PR: I.E. 213 and 250 or consent. Analytical modeling of waiting line systems with emphasis on determining the best operating conditions for those systems. Single-channel and multi-channel models. Computational methods (including Monte Carlo techniques) are examined. Applications to problems such as maintenance and inventory control.
453. *Theory of Linear Programming*. 3 hr. PR: I.E. 250 or consent. Study of procedures available for solving large-scale problems using linear programming. Topics include decomposition techniques, multiple pricing, cycling, inverse generation and storage, ranging procedures, and upper bound algorithms.
454. *Inventory Theory*. 3 hr. PR: I.E. 213 and 250 or consent. Techniques used in optimization of inventory systems. Elements of static, deterministic inventory models, and static, stochastic inventory models. Dynamic inventory models. Selected topics related to inventory analysis.
455. *Probability Theory for Engineers*. 3 hr. PR: I.E. 213 or consent. Probability theory and its application to industrial systems with particular emphasis on inventory, queueing, maintenance, reliability, and quality control systems. Markov processes are covered.
456. *Applied Stochastic Processes*. 3 hr. PR: I.E. 455. Stochastic systems with emphasis on application to inventory and queueing theory. Conditional probability, Poisson processes, counting processes, renewal processes, Markov chains with discrete and continuous parameters.
457. *Dynamic Programming*. 3 hr. PR: I.E. 250 or consent. Introduction to basic structure and computational aspects of dynamic programming and applications including sequential decision problems, deterministic and probabilistic models over finite and infinite planning horizons and Markovian decision processes.
458. *Integer Programming and Applied Networks*. 3 hr. PR: I.E. 250 or consent. Introduction to application of integer programming and maximum flow networks to engineering and operations research problems. Emphasis on problem formulation and solution.
480. *Seminar*. 1-6 hr. PR: Consent. Discussion of research in industrial engineering and special problems.
484. *Advanced Digital Simulation*. 3 hr. PR: I.E. 284 or consent. Analysis and comparison of special purpose digital simulation languages such as GPSS, SIMSCRIPT, GASP, CSMF, DYANOMO, and JOB SHOP simulation.
497. *Research*. 1-15 hr.

(See Eng. 260 under General Engineering in Part 5.)

INDUSTRIAL RELATIONS

Randyl D. Elkin, *Director of the Industrial Relations Program*

225 Armstrong Hall

Degree Offered: M.S.

Graduate Faculty: Members Decker, Dix, Elkin, Schaupp, and Zeller. *Associate Members* Hooper, Humphreys, W. J. Smith, J. Summers, and Tapper.

Students may pursue a Master of Science (M.S.) degree in the Industrial and Labor Relations program.

Admission. To be admitted to a program as a *regular graduate student* the applicant must have earned an undergraduate grade-point average of at least 2.5 ($A = 4.0$), and must present a minimum of 21 hours of undergraduate work in the social sciences, these to include at least 3 hours in statistics and 3 hours

in labor economics. (For this purpose the social sciences include economics, history, political science, psychology, sociology, anthropology, and general science.)

An applicant with the required grade-point average who has not had the required hours in social sciences may be admitted as a *regular graduate student with deficiencies*. Such a student should remove the specified deficiencies, without graduate credit, in the first semester in residence.

An applicant with an undergraduate grade-point average of at least 2.25 but less than 2.5 may be approved for the program as a *special-provisional graduate student*. A student so classified is required to seek re-classification by the time 9 to 12 semester hours of course work have been completed; to be reclassified as a *regular graduate student* (either category) such a student must have achieved a grade-point average of at least 3.0 in the course work taken in Graduate School.

All applicants must submit scores on the general aptitude portion of the Graduate Record Examination. Admission is competitive. Meeting minimum requirements does not assure admission to the industrial relations program.

Performance. To be in good standing (and ultimately to receive a graduate degree) graduate students in degree programs are required to maintain a grade-point average of at least 3.0 in all course work undertaken in Graduate School.

Industrial and Labor Relations Program

To receive the master of science degree, the candidate may select either a thesis or a non-thesis program. The non-thesis program requires 36 hours of graduate work which will include the following 18 hours of required courses:

Economics 262 — Collective Bargaining, 3 hr., or

Economics 362 — Advanced Collective Bargaining, 3 hr.;

Industrial Relations 331 — Industrial Relations Psychology, 3 hr.;

Economics 211 — Micro Economic Analysis, 3 hr., or

Economics 212 — Macro Economic Analysis, 3 hr., or

Any 300-level, 3 hr. Economics course other than Economics 302, 362, and 390 (except that Economics 362 may be allowed if Economics 262 is taken).

Statistics 311 — Statistical Methods, 3 hr.;

Industrial Relations 430 — Two seminars in Industrial Relations, 3 hr. ea.

The remaining hours will be chosen from the following courses after consultation with the adviser. While the listed courses are preferred, considerable latitude may be given the student by the adviser to choose other courses which are particularly appropriate to the student's background and interest. Approval must be obtained in advance. To receive the master's degree at least 60 percent of the course work counted toward the graduate degree must be numbered at the 300-level and above.

Industrial Engineering	Hr.	Economics	Hr.
222 — Job Eval. and Wage Incent.	3	211 — Micro Econ. Analy.	3
260 — Human Factors Eng.	3	212 — Macro Econ. Analy.	3
261 — System Safety Eng.	3	260 — Hum. Res. Econ.	3
361 — Ind. Hygiene Eng.	3	263 — Labr. Mkt. Analy.	3
Management		301 — Managerial Econ.	3
217 — Personnel and Comp.	3	340 — Public Finance.	3
218 — Focal Points in Mgt.	3	345 — Industrial Org.	3
225 — Business Policy	3	360 — Adv. Labor Econ.	3
301 — Administrative Practice	3	364 — Seminar, Labor Econ.	3
316 — Adv. Personnel Mgt.	3	390 — Readings in Econ.	1-3
323 — Administrative Policy	3	491 — Adv. Study Topics	1-3
Public Administration		Law	
341 — Adm. Org. and Man.	3	360 — Compensation	3
343 — Public Personnel Adm.	3	371 — Labor Law I.	3
448 — Legal Environment	3	349 — Labor Law II.	2
443 — Pub. Sector Labor Rel.	3	Counseling and Guidance	
Industrial Relations		320 — Vocational Development and	
334 — Wrk. Grp. Dyn & Ldrshp.	3	Occupational Choices	3
337 — Exper. Ind. Interview	3	Sociology and Anthropology	
491 — Independent Study	1-6	203 — Collective Behavior	3
491 — Ind. Rel. Research	3	204 — Complex Organizations	3
491 — Women in Labr. Force	3	233 — Industrial Sociology	3
491 — Coal Labor Rel.	3	Statistics	
491 — Equ. Employ. Opportun.	3	312 — Statistical Methods 2	3

The thesis program requires 30 hours of graduate work which will include the 18 hours of required courses: 6 hours of Industrial Relations 497 — Thesis; and 6 hours of approved electives. An average of 3.0 must be maintained in courses taken before the thesis.

The industrial relations program requires that the student maintain a grade-point average of at least 3.0 on all work taken as a graduate student while enrolled in the College, including prescribed work taken to remove undergraduate deficiencies. In addition, the student must maintain a 3.0 average in all work counting toward the graduate degree. A student whose cumulative grade-point average falls below 2.75 will be placed on probation. If the student's average is not brought up to 2.75 by the end of the following semester, the student will be suspended from the program. A grade below C in any course taken while enrolled as a graduate student will result in suspension from this graduate program.

Industrial Relations (I.R.)

331. *Industrial Relations Psychology*. 3 hr. PR: Consent. Application of psychological principles and techniques to personnel relationships in industry and society. Topics include proficiency measurement, personnel selection, conditions of work and productivity, engineering psychology, work methods, and safety. Designed for industrial relations students.
334. *Work Group Dynamics and Leadership*. 3 hr. PR: Consent. Small group or individual research on topics related to leadership and group dynamics in the work environment including training and other human relations programs.
337. *Practicum in Industrial Interviewing*. 3 hr. PR: I.R. 331 and consent. Experiential learning of industrial interviewing techniques covering legal and technical aspects of employment interviewing and other types of interviewing.
430. *Seminar in Industrial Relations*. I, II. 1-6 hr.

491. *Advanced Study*. I, II. 1-6 hr.
496. *Graduate Seminar*. I, II. 1 hr.
497. *Research*. I, II. 1-15 hr.

JOURNALISM

P. Michael Ryan, *Director of Graduate Studies in Journalism*

306 Martin Hall

Degree Offered: M.S.J.

Graduate Faculty: Members Kearns, McCartney, Ryan, Seymour, and Stewart. Associate Members Atkins, Bond, Cremer, Elwood, Ours, Summers, and Van Camp.

The Master of Science in Journalism (M.S.J.) program in the Perley Isaac Reed School of Journalism is designed to help persons involved in the various aspects of mass communications better understand and cope not only with the increased complexity of their own field, but also with fields outside mass communications.

The program is designed to help each student reach full potential as a worker, teacher, or scholar in mass communications. The program is designed not only to prepare a student for a first job — although students who obtain the M.S.J. degree should excel in the skills of the profession — but also to prepare for long-term and productive career development through the study of history, literature, problems, trends, law and ethics, theory and research methods of mass communications, and through the study of related fields.

The M.S.J. program is intended to: (1) afford the liberal arts graduate an opportunity to concentrate advanced study in mass communication; (2) provide intensive study for persons who have undergraduate journalism training, but who wish to pool their journalistic skills with extensive knowledge in another substantive area or areas (e.g., political science, economics, science); and (3) give persons who have had considerable professional experience an opportunity to broaden their academic bases through carefully selected advanced studies.

Admissions and Advising

Admission to the M.S.J. program is limited to holders of baccalaureate or equivalent degrees from accredited institutions of higher learning. Applicants should have combined (verbal and quantitative portions) Graduate Record Examination (GRE) Aptitude Test scores of at least 1000 and overall grade-point averages (GPA) of at least 3.0 (on a 4.0 scale). Each applicant also should submit (to the director of graduate studies in the School of Journalism) a detailed essay explaining why the student wants to undertake graduate study in journalism, what the student hopes to get from the graduate journalism program, what the long-term goals are, and how graduate education in journalism can help achieve those goals.

An applicant who doesn't meet the minimum GRE and/or GPA requirement(s) may be accepted only if the low GPA and/or GRE scores are offset by other factors. Excellent recommendations, unusual grading patterns (e.g., a steady rise of grades), an outstanding statement of purpose, or examples of professional accomplishment sometimes can offset low GRE scores or a low GPA.

Students applying for admission to the M.S.J. program are encouraged to send non-returnable supporting materials to the director of graduate studies in the School of Journalism. Examples of published or unpublished writing, research or photography; a detailed listing of professional media experience or other relevant job experience; and other supporting materials will be considered by the admissions committee. All other materials (e.g., transcripts, GRE scores, application forms) should be sent to the Office of Admissions and Records.

A student who does not have a bachelor's degree in journalism or extensive professional experience must meet these additional requirements:

1. Must have completed a core of journalism courses, with subjects and grades acceptable to the School of Journalism, or
2. Must complete undergraduate journalism and other courses to be prescribed by the School of Journalism, or
3. Must demonstrate knowledge and competence in a number of journalism topics to be prescribed by the School of Journalism, or
4. Must meet a combination of the foregoing requirements.

All applications for admission will be considered by the director of graduate studies, one faculty member of the Graduate Studies Committee (GSC), and one student member of the committee. The faculty member of the GSC will have expertise in the area in which the potential student wishes to specialize. The application of a student interested in advertising, for instance, will be considered by the director of graduate studies, the student GSC members, and the faculty GSC member who has expertise in advertising. The GSC will consider special cases and appeals.

The director of graduate studies will advise all students about general problems and concerns, and a faculty resource person will be appointed as a consultant at the time each student is accepted into the program. Students who wish to "major" in public relations, for instance, will have a faculty resource person from that area. Students should consult the faculty resource persons primarily for information about courses to take, projects to undertake, special training to obtain, and appropriate outside areas for study in the area of specialization (e.g., news-editorial, public relations, advertising, broadcasting, history, fund raising).

Early in the student's program, usually by the completion of 6-9 credit hours of graduate course work, the student, the adviser, and the resource person will draw up a plan of study that will show the direction of the student's course work. The plan may also indicate a general time frame anticipated for the completion of this work and may contain the direction and outline of the research problem to be undertaken. This plan of study will become a part of the student's record, and will constitute, with some degree of specificity, the terms and conditions that the student must meet for completing the degree requirements. Subsequent changes in the plan of study must be approved by the student, the adviser, and the resource person.

A writing proficiency examination, administered by the Journ. 300 instructor, will be given twice during the course. Students who fail it the first time will receive counseling on their writing weaknesses and must pass the test the second time it is given to continue their journalism graduate studies.

Graduate Assistantships and Internships

Approximately four assistantships and ten internships are available in the School of Journalism each year. Graduate assistants typically teach classes,

handle laboratories, and assist senior professors with their courses. Interns typically work in mass communications-related jobs on campus to obtain solid professional experience.

Students receive stipends of approximately \$2,900 for the academic year and tuition remission for the entire year. Although sometimes renewed for a second year, assistantships and internships are granted for one academic year. Graduate assistants and interns typically work an average of 15 hours per week during the academic year.

Persons who want to be considered for assistantships or internships should have their applications on file with the director of graduate studies in the School of Journalism before March 1.

Program Requirements

The School of Journalism offers two tracks — the thesis track and the professional track — within the M.S.J. program.

The thesis track is generally a teaching-research program for persons who want to go on for a Ph.D. degree, teach in a community college, or conduct research in some areas of mass communications. Persons in the thesis track normally take research and theory courses both inside and outside the School of Journalism, statistics, and social science courses. The program culminates in a thesis, which is a scholarly study of an important aspect of mass communications.

The professional track is designed primarily for persons who wish to become excellent practitioners in some field of mass communications and who have little desire to teach or become mass communications scholars. Persons in the professional project track normally take communications and outside area courses that will help them become better practitioners. The program culminates in a professional project, which helps a student extend the student's knowledge about a given aspect of mass communications but which could be the sort of non-routine project on which the student might work as a professional.

Course Work

For the master's degree in journalism, the student must meet the following requirements:

Thesis Research Program. A minimum of 30 semester hours of acceptable graduate credit, including a thesis for 6 hours of credit.

(a) As part of the 30 hours, a minimum of 18 hours, including the thesis, in School of Journalism courses.

(b) Included in the 30 hours, a minimum of 9 hours in a minor conducted outside the School of Journalism.

Professional Program. A minimum of 30 semester hours of acceptable graduate credit, including a professional project for 6 hours of credit.

(a) As part of the 30 hours, a minimum of 18 hours, including the professional project, in School of Journalism courses.

(b) Included in the 30 hours, a minimum of 9 hours in a minor conducted outside the School of Journalism.

In either program, the candidate is allowed to take more than the minimum required number of hours.

Upper-Level Courses Required. In both programs, 60 percent of the graduate credits submitted for the degree must be in courses numbered 300 or above.

Grades. Course work must be completed with a minimum grade-point average of 3.0. The thesis and professional project will be graded as S or U (satisfactory or unsatisfactory).

Examination. The candidate for the master's degree will pass an oral examination on the thesis or professional project. In addition, the thesis or professional project will be evaluated as a test of the candidate's writing skill.

The kinds of courses taken in the M.S.J. program largely depend on each student's background and interests. The program is intended to accommodate students of differing academic and professional backgrounds and interests, and there are several "sequences" in which students may specialize.

A student typically will take all outside courses in one area (e.g., biology, political science, history), although the student may decide after consultation with the adviser to take courses in two or more outside areas. Courses outside the School of Journalism are selected by students in consultation with their advisers; outside courses selected, of course, are subject to the availability of space and prerequisite requirements in the offering departments.

Thesis/Professional Project

Each student must complete a thesis or professional project involving original work in the student's area of interest. *The student must have a thesis or professional project proposal written and a guidance committee selected by the end of the semester in which the first 12 hours of course work are completed.*

Each student is responsible for developing ideas for the thesis or project. Through consultations with members of the journalism faculty, the student determines faculty interests and areas of expertise, and ideas are refined to the point where the student has a significant and feasible idea in mind.

The student, with the approval of the Graduate Studies Committee, selects the journalism faculty member who would be best able to chair the advisory committee, subject to the agreement of the faculty member. If questions arise as to a faculty member's interest or knowledge, the student should find answers by direct inquiry to the faculty member or by consultation with the academic adviser or other members of the Graduate Studies Committee.

With the chairperson, the student further refines the project idea to a "preliminary proposal" stage, in which ideas and appropriate methodology are on paper, but not necessarily in formal proposal form.

After the student has written a preliminary proposal and selected a faculty chairperson, the student should select other members of the advisory committee, subject to their willingness to serve. *The advisory committee must consist of not fewer than four members, one from outside the School of Journalism; two persons must be members of the WVU graduate faculty.*

Working under the guidance of the advisory committee, the student prepares a complete thesis or project proposal, extended from the preliminary proposal. Guidance for preparing a proposal is available from the director of graduate studies.

The student then has a consultative meeting, during which final revisions of and refinements in the proposal are discussed with the members of the advisory committee. Notices of the public meeting (to which students are invited) must be placed in the boxes of all members of the School of Journalism faculty and posted outside the dean's office at least two weeks before the meeting. Two copies of the thesis or project proposal must be placed on reserve in the journalism reading room.

After the consultation, the committee votes to accept or reject the proposal. The student then works closely with the committee in the completion of the thesis or project. All committee members should be kept informed and consulted for advice (as needed and as desired by them) as the thesis or project develops.

After each member of the advisory committee is satisfied with the work, a public oral examination is scheduled. Two weeks' notice must be given to all faculty of the School of Journalism (notices should be placed in all faculty boxes and posted outside the dean's office). Two copies of the final thesis or project must be placed on reserve in the journalism reading room. Students also should file their shuttle sheets with the Graduate School two weeks before the date of the oral defense.

Only committee members may vote on acceptance or rejection of a thesis or project. A majority vote is sufficient to approve the thesis or project, although a dissenting vote may be recorded. Furthermore, at least three signatures (two of which must be signatures of graduate faculty members) must be on the approval sheet. If one committee member is outvoted and feels he/she cannot sign the approval sheet, he/she may resign from the committee. Such action may force a reconstitution of the committee and repetition of earlier mentioned steps leading to the oral examination.

The chairperson of the advisory committee will decide whether final corrections (after the oral examination) have been made properly, and he/she will check the style and form of the final typed version. The *MLA Stylesheet* should be carefully followed during preparation of a thesis or professional project.

Two copies of the final thesis or project should be delivered to the School of Journalism, two to the Graduate School, and one to each member of the advisory committee.

Maintenance of Scholarship

All students are expected to maintain satisfactory progress toward the degree. A student's graduate record begins with the first course credited to the degree and includes all subsequent courses. All students must maintain a grade-point average of at least 3.0 and complete all requirements within seven years. Students who fail to meet this standard will be dropped from the program permanently.

Each student working toward the M.S.J. degree must register for at least one semester hour each regular (Fall and Spring) semester. This enrollment may be in course work or in Journ. 497.

Foreign Students

Believing that mutual benefit is derived when students from other countries study in the WVU School of Journalism, the school welcomes foreign students. At the same time, the school recognizes that journalism, more than many other fields, requires language skill. To profit by journalism study and practice in the English language environment, foreign students must have a ready understanding of the American language idiom in English. They will be called on to follow rapid speech in interviews, press conferences, public addresses, and in the classroom, as well as to deal with abstract ideas communicated in English. Award of the master's degree in journalism attests to the student's facility in English. Moreover, in graduate study, foreign students must maintain the same 3.0 grade-point average required of other students.

Recognizing the language difficulty, the School of Journalism offers foreign students a transition semester. Unless students obviously are fluent in English and pass a test in which they demonstrate comprehensive knowledge of English fundamentals (grammar, punctuation, syntax, spelling), they will be offered a semester of undergraduate study (not for graduate credit), which will enable them to sharpen language skills. Such a transitional semester also will permit foreign students to study other selected courses in preparation for graduate study. These courses will help them adapt to the American system of journalism and to the new cultural environment.

Journalism (Journ.)

203. *Advertising Media Analysis*. I, II. 3 hr. PR: Journ. 113 or consent. Buying, estimating, scheduling of print and broadcast media. Preparation of media rationale for national campaigns based on research and statistical analysis and computerized data. Determination of advertising allocations; sales representation; promotion.
204. *Media Management*. I, II. 3 hr. PR: Journ. 113, 114, and 203 or consent. Planning of advertising appropriations in national and international print and broadcast media. Client, agency, media responsibilities. Evaluation of advertising. Presentation.
210. *Graphic Design*. II. 3 hr. PR: Journ. 110. Design layouts for print media. Includes buying, supervising and scheduling of art, typography, and print material. 2 hr. lec., 2 hr. lab.
215. *Advanced Print Copywriting*. II. 2 hr. PR: Journ. 50, 113, 114 or consent. Copy concepts, copy platforms, techniques and strategies. Preparation of copy and media for national campaign. 2 hr. lec., 2 hr. lab.
216. *Broadcast Copywriting and Studio Production*. I. 2 hr. PR: Journ. 50, 113, and 215 or consent. Writing and production of radio and television commercials. Includes preparation of scripts, storyboards, selection of talent, and studio direction. Two hr. lec.; 2 hr. lab.
220. *Writing for Magazines*. I, II. 3 hr. PR: Upper-division or graduate standing; Journ. 18 or equiv. preparation in grammar, punctuation, and spelling. Professional approach: magazine analysis, query letters, writing, rewriting; submitting manuscripts for publication.
221. *Public Relations Interning*. I, II. 3 hr. PR: Journ. 122 and 123. Open only to junior, senior, and graduate public relations majors. Student learns through on-the-job training and from reports of those who have on-the-job experience. Course structured along a public relations agency organization and operations.
222. *Public Relations Case Studies*. II. 3 hr. PR: Journ. 122 or 123. Seminar based on in-depth studies of public relations programs developed and applied in support of our institutions. Primary emphasis on successful campaigns, but unsuccessful efforts also will be examined for causes of failures.
225. *High School Publications Advising*. II. (Alternate Years.) 3 hr. PR: Journ. 18, 19, 113. (For students seeking Journalism certification.) Emphasizes writing styles, newspaper/yearbook layout, rights and responsibilities of the teacher, students, and school system. Enrollees will construct instructional portfolios based on research and classroom discussion concepts. (Course will not be offered in 1982-83.)
227. *History of Journalism*. I, II, S. 3 hr. PR: Hist. 52 and 53 or consent. Open to all University students. Impact of the American press on the nation; development of today's media from the beginnings in seventeenth century England and in the American colonies; great names in journalism; freedom of press and its current implications.

228. *Law of the News Media*. II. 3 hr. For seniors and graduate students. The law as it affects the mass media. Considered are such areas as libel, public records, criminal pre-trial publicity, freedom of information, obscenity.
230. *Editorial and Critical Writing*. I. 3 hr. Open to all University students. The student will analyze and write editorials and commentaries; study typical editorial pages and the ethics governing editorial page content; become familiar with libel, privacy, contempt, and other problems — operating and political — as they arise.
231. *Color Photography*. II. 3 hr. PR: Journ. 120 and 130 or consent. The theory of color slides and prints, including slide development, as applied to multi-media presentations for advertising and public relations. (Supplies will cost \$50.00-75.00.)
239. *Seminar in Advertising Management Problems*. I, II. 2 hr. PR: Senior standing and major or minor in advertising. Application of the study of advertising research, law and theory in the preparation of a national advertising campaign. Aspects of the campaign to cover marketing, research, creative, media, sales promotion, and presentation.
251. *Direct Mail Advertising*. I. 3 hr. PR: Journ. 113 and 114 or consent. Mailing, marketing, and creation of direct-mail letters, brochures, involvement pieces, and reply cards. Postal regulations, direct mail law, and printing procedures. Two lec., one lab.
284. *Public Affairs Reporting by Television*. I, II. 3 hr. PR: Journ. 183 and consent. Preparation and presentation of public issues via television. Methods of topic selection, research, organization of ideas and script development, alternate formats, ethical and legal constraints.
285. *Special Topics in Broadcast Journalism*. I, II. 1-3 hr. PR: Consent. Directed investigation of selected topics in broadcast journalism.
299. *Contemporary Media Issues and Ethics*. I, II. 3 hr. Required of all senior journalism majors. In-depth study of contemporary media issues such as right of access to media, morality in news and advertising, new FTC and FCC regulations, media responsibility to society, social responsibility of media professionals. Individual research papers on issues with ethical considerations.
300. *Introduction to Graduate Studies*. I. (No Credit.) Required of all graduate students; non-credit course designed to orient students to graduate study. (Class meets one hour a week.)
302. *Seminar in Communications Theory*. I. 3 hr. PR: Studies in human behavior. Communications theory drawing heavily on social psychology and sociology and anthropology. Philosophy of science. Theory as scientific knowledge. Characteristics of theory. Begin learning how to draw on experts, to apply theory.
304. *Mass Media and Society*. II. 3 hr. Required for all graduate students. Study of mass media and their role in and influence on society; includes analysis of the social, political, and economic determinants of media content and character.
312. *Fund Raising and Foundation Management*. I. 3-6 hr. Open to graduate students and to seniors with 3.0; consent. Seminar. Studies in fund raising, alumni relations, and foundation management.
315. *Seminar in Journalism Education*. I, S. 1-3 hr. Journalism education problems. Each student does an individual research project planned to provide for professional development as a journalism teacher. Emphasis on secondary school problems.
337. *Eighteenth-Century Journalism*. II. 3 hr. Importance of British and American periodicals in the political, cultural, and economic patterns of the century; especially emphasizes the role of Colonial journals in reducing regionalism and forging a nation.

339. *Seminar in Advanced Advertising Management Problems*. II. 3 hr. Recently developed ideas and techniques in advertising, advertising research, and media management.
341. *Special Topics*. I, II, S. 1-6 hr.
343. *International Communications*. I. 3 hr. International news gathering and dissemination — including wire services, broadcast satellites, and political barriers — will be examined, particularly as these factors affect a free exchange of information within the world community. Efforts by the United Nations to encourage news exchange and to lower news barriers will be a major case examination.
380. *Thesis*. I, II, S. 2-6 hr.
390. *Professional Project*. I, II, S. 2-6 hr. Non-thesis professional project for students preparing for some field in mass communications.
401. *Research Methods*. 3 hr. Study of quantitative methods common to research in communications. An introduction to sampling, measurement, analytic procedures and data collection as applied to communications research and practical journalistic problems. Critical evaluation of communications research reports.
402. *Seminar in Research Methods*. 3 hr. Advanced study of methodological techniques. Research project chosen from area of student's major interest. Written report of study undertaken is required.
490. *Teaching Practicum*. I, II, S. 1-3 hr.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Research*. I, II, S. 1-15 hr.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in its academic and cultural programs.

MATHEMATICS

Vadim Komkov, *Chairperson of the Department*

203 Eiesland Hall

Degree Offered: M.S.

Graduate Faculty: Members Chak, Goodykoontz, Gould, Henry, Hiergeist, Irwin, Johnson, Kim, Komkov, Miller, Randolph, Rankin, Reynolds, and Simons. Associate Members Derr, Diamond, Dowdy, Easton, Lightbourne, McDonough, Mays, Moseley, Peters, Peterson, Reynolds, and Schleusner.

The Department of Mathematics offers the Master of Science (M.S.) degree. Programs are designed to provide education for students desiring to study pure mathematics, for students who wish to do interdisciplinary work (in preparation for work in industry and elsewhere), and for students who are or intend to be teachers of mathematics.

Entering students should have the equivalent of the mathematics requirements for an undergraduate major at WVU. Students who desire a preparatory program for teaching at the secondary level should have completed the courses required for a teaching field in mathematics. Deficiencies may be remedied by the completion of recommended undergraduate courses or by examination. Such remedial work cannot be used to meet the degree requirements.

Each student, upon beginning a graduate program, will be assigned an Advisory Committee. The committee will assist the student in designing the plan of study which takes into account the student's interest and objectives. The program will usually include 30-33 hours of graduate courses. A thesis may account for at most 6 hours of the total. A final examination (comprehensive in nature) or project is required for the degree.

Students are expected to maintain at least a 3.0 (B) average in their mathematics courses and to present at least a 3.0 average in all work offered in fulfillment of the degree program.

For a more complete statement of requirements, the student is referred to the department's handbook for *Graduate Students in Mathematics*.

Mathematics (Math.)

213. *Partial Differential Equations*. II. 3 hr. PR: Math. 113 or consent. Introduces students in mathematics, engineering, and the sciences to methods of applied mathematics. First and second order equations, canonical forms, wave, heat and Laplace's equations, representation of solutions. (Course will not be offered in 1981-82.)
215. *Applied Modern Algebra*. II. 3 hr. PR: Consent. Introduction to group theory. Boolean algebras, monoids, finite-state and Turing machines with applications to computer design, algebraic coding theory and computer language, especially ALGOL. (Course will not be offered in 1981-82.)
217. *Applied Mathematical Analysis*. II. 3 hr. PR: Math. 18 or 51. The algebra and differential calculus of vectors, solution of the partial differential equations of mathematical physics, application of functions of a complex variable.
219. *Seminar in Applied Mathematics*. I, II. 1-12 hr.
224. *Mathematics of Compound Interest*. I. 3 hr. PR: Math. 16 or 128. A problem-solving course focusing on the measurement of interest, annuities, amortization schedules, and sinking funds, and the valuation of bonds and other securities.
226. *Mathematical Statistics*. II. 3 hr. PR: Math. 16 or consent. Designed for mathematics teachers. Frequency distributions, averages, probability, populations, samples, probability distributions, estimations, hypothesis testing. Although no previous knowledge of computer language is assumed, the computer will be used in this course.
- 231, 232. *Introduction to Mathematics for the Elementary Teacher*. I, II. 3 hr. per sem. PR: Math. 34 or consent. (Not open to students who have credit for Math. 131, 132.) For inservice elementary mathematics teachers. Systems of numeration; sets, relations, binary operations, the algebraic structure of various number systems; the notions of length, area, and volume; coordinate geometry. (Course will not be offered in 1981-82.)
239. *Elementary Number Theory*. II, S. 3 hr. PR: Math. 16 or Math. 131 or consent. A study of divisibility, congruences, linear and quadratic diophantine equations, number theoretic functions, and applications of number theory to other areas of mathematics. (Course will not be offered in 1981-82.)
241. *Applied Linear Algebra*. I, II. 3 hr. PR: Math. 18 or 51. Matrix algebra with emphasis on algorithmic techniques and applications of physical models. Topics include: solution of large systems of equations, orthogonal projections and least squares, eigenvalue problems.
- 251, 252. *Introduction to Real Analysis*. I, II. 3 hr. per sem. PR: Math. 163 or consent. A study of sequences, convergence, limits, continuity, definite integral, the derivative, differentials, functional dependence, multiple integrals, sequences and series of functions.

255. *Advanced Real Calculus*. S. 3 hr. Math. 51 or consent. Limits, series, metric spaces, uniformity, integrals.
256. *Complex Variables*. II. 3 hr. PR: Math. 18 or 51. Complex numbers, functions of a complex variable; analytic functions; the logarithm and related functions; power series; Laurent series and residues; conformal mapping and applications.
269. *Advanced Topics in Mathematics*. I, II, S. 3-9 hr. PR: Consent. An independent but directed study program, the content of which is to be mutually agreed upon by the individual student and instructor.
271. *Projective Geometry*. II. 3 hr. PR: Math. 141, 241, or consent. Projective and affine spaces, transformation groups for planes. Introduction to axiomatic plane geometries. (*Course will not be offered in 1981-82.*)
- 291, 292. *Theory of Probability*. I, II. 3 hr. per sem. PR: Math. 18 or 51. Fundamental theorems. Development of density and distribution functions in the discrete and continuous cases. Classical problems and solutions. Moments, characteristics functions, limit theorems. Applications. (*Course will not be offered in 1981-82.*)
- 301, 302. *Combinatorial Analysis*. I, II. 3 hr. per sem. PR: One year of calculus. Permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, compositions, trees and networks.
- 305, 306. *Theory of Numbers*. I, II. 3 hr. PR: One year of calculus. Introduction to classical number theory, covering such topics as divisibility, the Euclidean algorithm, Diophantine equations, congruences, primitive roots, quadratic residues, number-theoretic functions, distribution of primes, irrationals, and combinatorial methods. Special numbers such as those of Bernoulli, Euler, and Stirling. (*Course will not be offered in 1981-82.*)
313. *Intermediate Differential Equations*. II. 3 hr. PR: Math. 17, 18. A rigorous study of ordinary differential equations including linear and non-linear systems, self-adjoint eigenvalue problems, non-self-adjoint boundary-value problems, perturbation theory of autonomous systems, Poincare-theorem.
314. *Tensor Analysis*. II. 3 hr. PR: Math. 214, 252 (or 318). Inner product vector spaces, bilinear forms, tensors as multilinear forms, geodesic differentiation, theory of curvature of general manifolds. (*Course will not be offered in 1981-82.*)
315. *Operational Methods in Partial Differential Equations*. II. 3 hr. PR: Math. 113, 252, (or 318). Laplace transformation, properties and elementary applications; problems in partial differential equations; complex variable; problems in heat conduction; mechanical vibration, etc. Sturm-Liouville systems. Fourier transforms. (*Course will not be offered in 1981-82.*)
- 317, 318. *Advanced Calculus*. I, II. 3 hr. per sem. PR: Math. 18. Primarily for engineers and scientists. Functions of several variables, partial differentiation, implicit functions, transformations; line surface and volume integrals; point set theory, continuity, integration, infinite series and convergence, power series, and improper integrals.
319. *Seminar in Applied Mathematics*. 1-12 hr.
320. *Numerical Solution of Linear Equations*. 3 hr. Math. 322 or consent. Numerical solution of large systems of linear equations using direct and iterative methods. Calculation of inverses and generalized inverses of matrices. Numerical methods for the determination of eigenvalues and eigenvectors. (Equiv. to Com. S. 320.)
- 321, 322. *Introduction to Numerical Analysis*. I, II. 3 hr. per sem. PR: Math. 51 and Math. 241 or Math. 214 or consent. Approximation of functions, iteration procedures, numerical integration and differentiation, numerical solution of linear and nonlinear

equations, and ordinary differential equations, error analysis and pitfalls of computation. (Equiv. to C.S. 220 and 221.)

330. *Introduction to Applied Mathematics*. S. 1-6 hr. PR: Calculus or consent. (Designed especially for secondary-school mathematics teachers; others admitted with departmental approval obtained before registration.) Problem solving and construction of mathematical models in the social, life and physical sciences. Examples illustrating the origins and use of secondary school mathematics in solving real world problems.
333. *Modern Algebra for Teachers*. I, S. 3 hr. PR: Calculus or consent. Designed especially for secondary school mathematics teachers. Others admitted with departmental approval obtained prior to registration. Introduction to algebraic structures: groups, rings, integral domains and fields. Development and properties of the rational and real number systems.
334. *Modern Algebra for Teachers*. II, S. 3 hr. PR: Math. 141 or 333 or consent. Further investigation of algebraic structures begun in Math. 333. (Emphasis on topics helpful to secondary-school mathematics teachers.) Topics include Sylow theory, Jordan-Holder Theorem, rings and quotients, field extensions, Galois theory and solution by radicals.
335. *Foundations of Geometry*. S. 3 hr. PR: Calculus or consent. (Designed especially for secondary mathematics teachers; others admitted with departmental approval obtained before registration.) Incidence geometries with models; order for lines and planes; separation by angles and by triangles; congruence; introduction to Euclidean geometry.
336. *Transformation Geometry*. S. 3 hr. PR: Math. 141 or 333 or consent. (Designed especially for secondary school mathematics teachers; others admitted with departmental approval obtained before registration.) A modern approach to geometry based on transformations in a vector space setting. The course unifies the development of geometry with the methods of modern algebra.
337. *Foundations of Probability and Statistics*. S. 3 hr. PR: Calculus or consent. (Designed especially for secondary school mathematics teachers; other admitted with departmental approval obtained before registration.) Introduction to probability and statistics with emphasis on topics helpful to secondary school mathematics teachers. Topics include: density and distribution functions, probability distributions, sampling, confidence intervals, point estimation, hypothesis testing, student's t-distribution. Chi-square distribution.
339. *Special Topics*. I, II, S. 1-12 hr.
- 341, 342. *Modern Algebra*. I, II. 3 hr. per sem. PR: Math. 141 or consent. Concepts from set theory and the equivalence of the Axiom of Choice. Zorn's Lemma and the Well-Ordering Theorem; a study of the structure of groups, rings, fields, and vector spaces; elementary factorization theory; extensions of ring and fields; modules and ideals; and lattices.
343. *Linear Algebra*. II, S. 3 hr. PR: Math. 241 or consent. Review of theory of groups and fields; linear vector spaces including the theory of duality; full linear group; bilinear and quadratic forms; and theory of isotropic and totally isotropic spaces.
- 351, 352. *Theory of Functions of Real Variables*. I, II. 3 hr. per sem. PR: Math. 181, 252. A development of the Lebesgue integral, function spaces and Banach spaces, differentiation, complex measures, the Lebesgue-Radon-Nikodym theorem.
- 355, 356. *Theory of Functions of Complex Variables*. I, II. 3 hr. per sem. PR: Math. 252. Number systems, the complex plane and its geometry. Holomorphic functions, power series, elementary functions, complex integration, representation theorems, the calculus of residues, analytic continuation and analytic function, Elliptic functions, Holomorphic functions of several complex variables.

357. *Calculus of Variations*. II. 3 hr. PR: Math. 113, 252, (or 318). Necessary conditions and sufficient conditions for weak and strong relative minimums of an integral, Euler-Lagrange equation. Legendre condition, field construction, Weierstrass excess function, and the Jacobi equation.
- 381, 382. *Topology*. I, II. 3 hr. per sem. PR: Math. 252 or consent. A detailed treatment of topological spaces covering the topics of continuity, convergence, compactness, and connectivity; product and identification spaces, function spaces, and the topology in Euclidean spaces.
- 385, 386. *Rings of Continuous Functions*. I, II, S. 3 hr. per sem. PR: Math. 341 and Math. 381, or consent. A study of the algebraic structure of the ring of all continuous real-valued functions on a topological space and its relation to the topological properties of the space. (Course will not be offered in 1981-82.)
400. *Seminar in Number Theory*. I, II. 1-12 hr. (Course will not be offered in 1981-82.)
402. *Special Functions*. I, II. 3 hr. PR: Math. 113, 252. Operational techniques, generalized hypergeometric functions, classical polynomials of Bell, Hermite, Legendre, Noerlund, etc. Introduction to recent polynomial systems. Current research topics. (Course will not be offered in 1981-82.)
- 405, 406. *Analytic Number Theory*. I, II. 3 hr. per sem. PR: Math. 306, 356. Selected topics in analytic number theory such as the prime number theorem, primes in an arithmetical progression, the Zeta function, the Goldbach conjecture. (Course will not be offered in 1981-82.)
409. *Seminar in Special Functions*. I, II. 1-12 hr. (Course will not be offered in 1981-82.)
440. *Seminar in Algebra*. I, II. 1-12 hr. (Course will not be offered in 1981-82.)
- 441, 442. *Group Theory*. I, II. 3 hr. per sem. PR: Math. 141 or consent. Elementary group theory; Sylow theory, extended Sylow theory in solvable groups, Burnside's theorem on normal complements, transfer homomorphism. Representation theory. Emphasis throughout on finite groups. (Course will not be offered in 1981-82.)
- 443, 444. *Algebraic Theory of Semigroups*. I, II. 3 hr. per sem. PR: Math. 342 or equiv. Ideal theory, matrix representation of semigroups, decompositions and extensions, simple semigroups, inverse semigroups, congruence relations, recent research. (Course will not be offered in 1981-82.)
450. *Seminar in Analysis*. I, II. 1-12 hr. (Course will not be offered in 1981-82.)
- 451, 452. *Functional Analysis*. I, II. 3 hr. per sem. PR: Math. 181, 241, 252. A study of Banach and Hilbert spaces; the Hahn-Banach theorem, uniform boundedness principle, and the open mapping theorem; dual spaces and the Riesz representation theorem; Banach algebras; and special theory. (Course will not be offered in 1981-82.)
- 457, 458. *Theory of Partial Differential Equations*. I, II. 3 hr. per sem. PR: Math. 252. Cauchy-Kowalewski theorem, Cauchy's problem, the Dirichlet and Neumann problems, Dirichlet's principle, potential theory, integral equations, eigenvalue problems, numerical methods. (Course will not be offered in 1981-82.)
460. *Thesis*. I, II. 1-6 hr.
470. *Seminar in Geometry*. I, II. 1-12 hr. (Course will not be offered in 1981-82.)
- 471, 472. *Algebraic Geometry*. I, II. 3 hr. per sem. PR: Math. 141, 271. Foundations of affine geometry, the geometry of quadratic forms. Structure of the general linear group, symplectic groups, and orthogonal groups. (Course will not be offered in 1981-82.)
480. *Seminar in Topology*. I, II. 1-12 hr. (Course will not be offered in 1981-82.)

490. *Teaching Practicum*. I, II. 1-3 hr. PR: Consent. Supervised practices in college teaching of mathematics.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of the student's program.
497. *Research*. 1-15 hr.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in its academic and cultural programs.

MECHANICAL ENGINEERING AND MECHANICS

Robert D. Slonneger, *Acting Chairperson of the Department*

325 Engineering Sciences Building

Degrees Offered: M.S.M.E., M.S.E., Ph.D.

Graduate Faculty: Members Bajura, Haynes, Johnson, Martin, Neou, Plants, Powell, Salamon, Sneckenberger, Steinhardt, and Venable. Associate Members Avery, Dean, Gencsoy, Notestein, Padhye, Pitrolo, Schrider, Shuck, Slonneger, and Strickland.

The Department of Mechanical Engineering and Mechanics has programs leading to the degrees of Master of Science in Mechanical Engineering (M.S.M.E.) and Master of Science in Engineering (M.S.E.), and participates in the College of Engineering Interdisciplinary Ph.D. program. There are four major areas of study within the department which enable students to pursue broad or concentrated educational programs. These areas are (1) solid mechanics and machine design; (2) dynamics, vibrations, and controls; (3) fluid engineering; and (4) thermal energy. A student's program may emphasize either the design or research aspects of engineering. The department also cooperates with the WVU Medical Center in offering a program in Bio-engineering, and several faculty members are actively involved in programs leading to advanced degrees in Engineering Education.

The educational objectives of the departmental master's degree programs are:

(1) To provide advanced, and often terminal, training for students in or entering the engineering profession, and/or

(2) To provide the basic graduate educational experience for students wishing to pursue the Ph.D.

The objectives of the Ph.D. program are to develop in-depth expertise in the student's major interest while providing a broad base of knowledge of the many areas which comprise the discipline of mechanical engineering.

The department has laboratory space on two floors in the Engineering Sciences Building and provides support for both education and research programs through the services of two shop facilities. Laboratory and analytical projects completed by graduate students in the recent past include topics in coal combustion and gasification, properties of coal, design of coal handling equipment, energy storage, energy conservation and management, modeling of environmental flows, railroad car dynamics, automobile vehicle dynamics, pulsatile flow metering, acoustic analysis of power systems, air flow in lungs, and biomechanical properties of bone and tissue.

Master of Science in Mechanical Engineering (M.S.M.E.)

Master of Science in Engineering (M.S.E.)

Students wishing to pursue a program leading to an M.S.M.E. degree should have a B.S.M.E. from an accredited ABET curriculum, or its equivalent. Students with an engineering background other than mechanical engineering normally will be required to strengthen their background.

The program of study must consist of a minimum of 30 semester hours of approved graduate-level courses which include at least 6 hours of mathematics, 3 hours of engineering methods, and 12 total hours of courses from at least two areas of study in the Department of Mechanical Engineering and Mechanics. The program of study may be structured to consist of 30 hours (minimum) of course work, or may include either a thesis or a problem report. The student's plan of study is formulated jointly with his/her advisory committee based upon the interests and educational goals of the student. A final examination is required of all candidates for the degree.

The M.S.E. program administered by the department generally is intended for students who desire to do graduate work in areas other than their baccalaureate major. Students desiring to pursue such a program in the Department of Mechanical Engineering and Mechanics must meet similar general requirements as for the M.S.M.E., although their overall program may be more flexible.

Each plan of study in the M.S.E. program must include 6 hours of mathematics, 9 hours from any two areas in the department, and 3 hours of engineering methods. The plan of study may follow the straight course work, thesis, or problem report programs applicable to the M.S.M.E. programs. A final examination is required.

Doctor of Philosophy (Ph.D.)

Students intending to pursue a Ph.D. program in the Department of Mechanical Engineering and Mechanics should have earned a B.S. or an M.S. degree in some discipline of engineering. While it is possible for a student with a B.S. degree to enroll directly in the Ph.D. program, it is usually advisable to earn a master's degree first.

As with the department's master's programs, the courses of study are selected to fit the individual interests and objectives of the student, with proper attention given to broadening related areas of study and meeting the College of Engineering interdisciplinary curriculum requirements. Generally, a typical Ph.D. program will conform to the following outline:

First Year — Master's Degree

Second Year —

- (a) An approved program of study consisting of approximately 30 credit hours of 300 and 400 series courses (some approved 200 series courses are acceptable).
- (b) Admission to Candidacy
 - i. Qualifying examinations covering any three of the four major areas of study in M.E.M.
 - ii. Defense of research proposal.
 - iii. Completion of all program requirements.

Third Year —

(a) Dissertation

(b) Final Examination

A year of study refers to a level of achievement which can be attained by full-time students. If a student performs half-time service to the department in the form of a teaching or research assistantship, the length of time for completion of the program may exceed three calendar years. The research work for the doctoral dissertation may entail a fundamental investigation into a specialized area or a broad and comprehensive program of study.

Mechanical Engineering and Mechanics (M.E.M.)

- 200. *Advanced Mechanics of Materials I. II.* 3 hr. PR: M.E.M. 43 or consent. Theories of failure and design procedures; time and temperature dependent behavior; shear center, unsymmetrical bending, curved beams. 3 hr. rec.
- 204. *Dynamics of Physical Systems. I.* 3 hr. PR: M.E.M. 42 and Math. 18 or consent. Physical systems such as hydraulic, mechanical, electrical, electromechanical, electrohydraulic, hydromechanical, and thermodynamic considered. Emphasis on the modeling of compound systems and studying their natural behavior using analytical techniques. Use of computers in analysis of physical systems.
- 210. *Kinematics. II.* 3 hr. PR: M.E.M. 112 and Math. 18 or consent. Geometry of constrained motion, kinematics synthesis and design, special linkage. Coupler curves, inflection circle, Euler-Savary equation, cubic of stationary curvature and finite displacement techniques. 3 hr. rec.
- 222. *Mechanical Vibrations. II.* 3 hr. PR: Math. 18, M.E.M. 112, or consent. Fundamentals of vibration theory. Free and forced vibration of single and multiple degree of freedom systems. Solution by Fourier and Laplace transformation techniques. Transient analysis emphasized. Energy methods. 3 hr. rec.
- 232. *Introduction to Feedback Control. II.* 3 hr. PR: Math. 18, E.E. 105 or M.E.M. 204 or consent. Fundamentals of automatic control theory. Transfer functions and block diagrams for linear physical systems. Proportional, integral, and derivative controllers. Transient and frequency response analysis using Laplace transformation.
- 236. *Systems Analysis of Space Satellites. II.* 3 hr. PR: Senior standing. Introduction to engineering principles associated with analysis and design of space satellites. Emphasis on the interdisciplinary nature of satellite systems analysis. 3 hr. rec.
- 238. *Introduction to Underwater Engineering. I.* 3 hr. PR: Consent. Underwater portion of our world with emphasis on science and technology. Emphasis on economic and social needs for maritime resources, maritime law, and public policy, as well as general and basic engineering aspects of underwater communication, navigation, and structures.
- 240. *Problems in Thermodynamics. II.* 3 hr. PR: M.E.M. 141 or consent. Thermodynamic systems with special emphasis on actual processes. Problems presented are designed to strengthen the background of the student in the application of the fundamental thermodynamic concepts. 3 hr. rec. (Course will not be offered in 1980-81.)
- 242. *Bioengineering. II.* 3 hr. Introduction to human anatomy and physiology using an engineering systems approach. Gives engineering student basic understanding of the human system so that the student may include it as an integral part of the design.
- 244. *Introduction to Gas Dynamics. II.* 3 hr. PR: M.E.M. 144 or consent. Basic fundamentals of gas dynamics, one-dimensional gas dynamics and wave motion, methods of measurement, effect of viscosity and conductivity, and concepts from gas kinetics. 3 hr. rec.

250. *Heat Transfer. I, II.* 3 hr. PR: M.E.M. 101 or 140. Steady rate and transient conduction. Thermal radiation. Boundary layer equations and forced and free convection are also covered. 3 hr. rec.
254. *Applications in Heat Transfer. I.* 3 hr. PR: M.E.M. 250. For students desiring to apply basic heat transfer and digital computation techniques to problems involving heat exchangers, power plants, electronic cooling, manufacturing processes, and environmental problems.
262. *Internal Combustion Engines. II.* 3 hr. PR: M.E.M. 101 or 141. Thermodynamics of internal combustion engine; Otto cycle; Diesel cycle, gas turbine cycle, two- and four-cycle engines, fuels, carburetion and fuel injection; combustion; engine performance, supercharging. 3 hr. rec.
264. *Heating, Ventilating, and Air Conditioning. II.* 3 hr. PR: M.E.M. 141 or consent. Methods and systems of heating, ventilating, and air conditioning of various types of buildings, types of controls and their application. 3 hr. rec.
282. *Engineering Acoustics. II.* 3 hr. PR: Math. 18 or consent. Basic theory of sound propagation and transmission. Identification of important industrial noise sources and sound measurement equipment. Selection of appropriate noise criteria and control methods. Assessment of noise abatement technology. Laboratory studies and case histories.
290. *Seminar. I, II, S.* 1-6 hr. PR: Junior, senior, or graduate status, and consent.
294. *Special Topics. I, II, S.* 1-6 hr. PR: Junior, senior, or graduate status, and consent.
299. *Special Problems. I, II, S.* 1-6 hr. PR: Junior, senior, or graduate status.
301. *Advanced Engineering Acoustics. II.* 3 hr. PR: M.E.M. 282 or consent. Study of complex sound generation and the propagation, transmission, reflection, and absorption of airborne and structure-borne sound. Coupling of sound and vibration in structures. Acoustical behavior and characteristics of materials.
305. *Analytical Methods in Engineering I. I.* 3 hr. PR: Consent. Index notation for determinants, matrices, and quadratic forms; linear vector spaces, linear operators including differential operators; calculus of variations, eigenvalue problems, and boundary value problems.
306. *Analytical Methods in Engineering II. II.* 3 hr. PR: M.E.M. 305 or at least two semesters of advanced calculus. Intended for advanced graduate students interested in modern analysis for engineering applications.
307. *Non-Linear Analysis in Engineering. II.* 3 hr. PR: Consent. Special topics in non-linear analysis of various types of engineering systems. Various numerical, approximate, and analytical techniques chosen to suit the needs and interests of advanced graduate students.
310. *Advanced Mechanics of Materials II. I.* 3 hr. PR: Consent. Beams on elastic support, cylindrical shells with bending, torsion of noncircular members, two-dimensional applications in elasticity, contact stresses, and simple problems in plates and shells. 3 hr. rec.
312. *Inelastic Behavior of Engineering Materials. II.* 3 hr. R: M.E.M. 41, 42, 43, and consent. Characterization and modeling of typical engineering materials, elastic, visco-elastic, and plastic materials, design considerations.
316. *Energy Methods in Applied Mechanics. I.* 3 hr. PR: Consent. Variational principles of mechanics and applications to engineering problems; principles of virtual displacements, minimum potential energy, and complementary energy. Castigliano's theorem. Hamilton's principle. Applications to theory of plates, shells, and stability. 3 hr. rec.

318. *Continuum Mechanics. I.* 3 hr. PR: M.E.M. 41, 42, 43. Emphasizes the basic laws of physical behavior of continuous media. Analysis of stress; equations of motion and boundary conditions; kinematic analysis; rates of strain, dilation and rotation; bulk time, rates of change; constitutive equations with special attention to elastic bodies and ideal fluids; energy equations and the first law of thermodynamics. 3 hr. rec.
320. *Theory of Elasticity I. I.* 3 hr. Cartesian tensors; equations of classical elasticity, energy, minimum, and uniqueness theorems for the first and second boundary value problems; St. Venant principle; extension, torsion, and bending problems. 3 hr. rec.
322. *Advanced Vibrations I. II.* 3 hr. PR: M.E.M. 222 or consent. Dynamic analysis of multiple degree of freedom discrete vibrating systems. Lagrangian formulation, matrix and numerical methods, impact and mechanical transients.
325. *Experimental Stress Analysis. II.* 3 hr. PR: M.E.M. 41, 42, 43. Classical photoelasticity, brittle lacquers, birefringent coatings, strain gage techniques and instrumentation, as applied to problems involving static stress distributions. 2 hr. rec., 3 hr. lab.
330. *Instrumentation in Engineering I. I.* 3 hr. PR: Consent. Theory of measuring systems, emphasizing measurement of rapidly changing force, pressure, strain, temperature, vibration, etc. Available instruments, methods of noise elimination, types of recording studied. Special value to students in experimental research. 2 hr. rec., 3 hr. lab.
333. *Advanced Machine Design. I.* 3 hr. PR: M.E.M. 134 or consent. Design for extreme environments, material selection, lubrication and wear, dynamic loads on cams, gears, and bearings, balancing of multiengines and rotors, electromechanical components.
340. *Advanced Thermodynamics I. I.* 3 hr. PR: M.E.M. 141. First and second laws of thermodynamics with emphasis on the concept of entropy production. Application to a variety of nonsteady open systems, thermodynamics of multiphase, multicomponent and reacting systems. Criteria for equilibrium and stability.
342. *Advanced Thermodynamics II. II.* 3 hr. PR: M.E.M. 340 or consent. Continuation of topics related to reactive systems. Adiabatic flame temperatures, reaction kinetics, conservation of species equations, flame propagation and detonation.
344. *Statistical Thermodynamics. II.* 3 hr. PR: M.E.M. 340 or equiv. Microscopic thermodynamics for Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Schrodinger wave equation, partition functions for gases and solids.
348. *Heat Transfer. I.* 3 hr. PR: Undergraduate course in heat transfer or consent. Graduate course in heat transfer primarily for mechanical engineering students. Topics include one-, two-, and three-dimensional thermal conduction involved in mechanical processes both for constant and time varying temperature fields, free and forced convection in heat exchangers, heat power equipment and aircraft and radiative heat transfer between surfaces and absorbing media as found in furnaces, industrial processes, and aerospace applications.
350. *Conduction Heat Transfer. I.* 3 hr. PR: M.E.M. 250 or consent. Analytical, numerical, graphical, and analog solutions of steady and non-steady heat conduction problems in isotropic and anisotropic solids. Thermal properties, extended surfaces, thermal stress, interphase conduction with moving interface, localized and distributed sources.
352. *Intermediate Dynamics. II.* 3 hr. PR: M.E.M. 42. Newtonian and Lagrangian mechanics. Dynamics of discrete systems and rigid bodies analyzed utilizing Newtonian and Lagrangian formulations.
353. *Advanced Dynamics I. I.* 3 hr. PR: M.E.M. 352 or consent. Analytical mechanics. Stability of autonomous and nonautonomous systems considered and analytical

solutions by perturbation techniques introduced. Hamilton-Jacobi equations developed. Problems involving spacecraft, gyroscopes and celestial mechanics studied.

354. *Convection Heat Transfer*. II. 3 hr. PR: M.E.M. 250 or consent. Laminar and turbulent flows. Analytical, numerical, and analogical solution. Selected topics study of current research publications.
355. *Radiation Heat Transfer*. II. 3 hr. PR: M.E.M. 250 or consent. Classical derivation of black body radiation laws; gray body and non-gray analysis; radiant properties of materials, radiant transport analysis, specular-diffuse networks, gas radiation, thermal radiation measurements; analytical, numerical solutions, and study of selected current publications.
360. *Fluid Mechanics I*. I. 3 hr. PR: M.E.M. 144 or equiv. Advanced dynamics and thermodynamics of fluids. Basic laws of conservation of mass and momentum in differential, vector, and integral forms. Application to internal flows, fluid machinery, and structures.
364. *Turbomachinery*. I. 3 hr. PR: M.E.M. 101 or 141. Flow problems encountered in design of water, gas, and steam turbines, centrifugal and axial flow pumps and compressors, design parameters.
384. *Feedback Control in Mechanical Engineering*. I. 3 hr. PR: M.E.M. 232 or consent. Control analysis of hydraulic and pneumatic closed-loop systems including spool valves, flapper valves, pumps, servomotors, and electrohydraulic servomechanisms. Investigation of nonlinearities by phase plane, Liapunov, and describing function techniques. Programming for analog and digital computer simulation. Introduction to fluidic elements and logic circuits.
394. *Special Topics*. I, II, S. 1-6 hr. For senior and graduate students.
399. *Special Problems*. I, II, S. 1-6 hr. For senior and graduate students.
414. *Theory of Elastic Stability*. I. 3 hr. PR: Consent. Stability of discrete mechanical systems, energy theorems, buckling of beams, beam columns, and frames, torsional buckling, buckling of plates and shells, special topics.
419. *Topics in Fluids and Solids*. II. 3 hr. PR: Consent. Finite elasticity and viscoelasticity, non-Newtonian fluids, non-linear constitutive theories, special topics in solids and fluids.
421. *Theory of Elasticity II*. II. 3 hr. PR: M.E.M. 320 (or M.E.M. 310 and consent). Complex variable methods, potential methods, elastic-viscoelastic correspondence principle, boundary value problems, various special topics. 3 hr. rec.
422. *Advanced Vibrations II*. II. 3 hr. PR: M.E.M. 222, M.E.M. 322 or consent. Dynamic analysis of continuous media. Vibration and wave motion analysis of strings, elastic bars, beams, plates and fluid columns. Earthquake wave propagation.
424. *Theory of Plates and Shells*. II. 3 hr. PR: M.E.M. 310. Theory of rectangular and circular plates, membrane shells of revolution, shells with bending stiffness, dynamic response of plates and shells.
428. *Photomechanics*. II. 3 hr. PR: M.E.M. 200, 325. Theory of optics, birefringence, stress-optic law, polariscope, compensation. Techniques of model making, photography, polariscope use. Photoelastic coating methods and use of various reflective polariscopes. Data interpretation by various methods including principal stress separation by shear difference, oblique incidence and graphical integration. 2 hr. rec., 3 hr. lab.
431. *Instrumentation in Engineering II*. II. 3 hr. PR: M.E.M. 330. Continuation of M.E.M. 330 with emphasis on transducers for static and dynamic measurement and their use in practical measuring systems. 3 hr. rec.

440. *Irreversible Thermodynamics I*. I. 3 hr. PR: M.E.M. 340 or consent. Phenomenological treatment of the laws of dynamics and thermodynamics for irreversible processes in continuous media. Linear laws for combined irreversible phenomena including viscous dissipation, heat conduction, diffusion, chemical reactions and electric and magnetic effects, are developed taking into account Curie's principle and the Onsager relations. The principle of the minimum rate of creation of entropy is extended to establish criteria for the stability of stationary states. Tensor and variational methods are employed.
441. *Irreversible Thermodynamics II*. II. 3 hr. PR: M.E.M. 440. Continuation of M.E.M. 440 with emphasis on selected topics from such applications as thermoelectricity, anisotropic heat conduction, stability of fluid motion, thermal diffusion and separation, viscochemical drag, electro chemical cells, and other coupled phenomena of physical or biological interests.
454. *Advanced Dynamics II*. II. 3 hr. PR: Consent. Advanced study in dynamics. Topics covered are either non-linear vibration, advanced control theory or stability theory depending on student demand.
461. *Fluid Mechanics II*. II. 3 hr. PR: M.E.M. 360 or equiv. Statistical nature of turbulence, correlation functions and fourier representations. Kinematics of isotropic and nonisotropic turbulent flows. Experimental methods. Application to dynamic loading on structures, diffusion and dispersion of contaminants by turbulent fields and heat and mass transfer.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Advanced study in areas not covered by formal courses.
492. *Seminar: Engineering Education*. I, II, S. 1-6 hr. PR: Consent. Studies and group discussion of selected problems in engineering education. Emphasis on application of educational principles to specific areas in engineering education.
493. *Seminar: Bioengineering*. I, II, S. 1-6 hr. PR: Consent. An exposition of contemporary topics in bioengineering. Topics include advancements in biomedical instrumentation, prosthetics, cardiovascular research, biological controls, biomechanics, neurophysiological research, human factors and anthropometrics.
494. *Seminar*. I, II, S. 1-6 hr. PR: Consent. Discussion, library readings, and individual study reports in the mechanical engineering field.
497. *Research*. I, II, S. 1-15 hr. PR: Graduate standing.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use University facilities and participate in its academic and cultural programs.

(See Eng. 260 under General Engineering in Part 5.)

MEDICAL TECHNOLOGY

Betholene F. Love, *Director of the Program*

2138 Basic Sciences Building

Degree Offered: M.S.

Graduate Faculty: Members Jagannathan, Krall, Love, Mengoli, Moore, and Rodman.

The WVU Medical Technology graduate program prepares graduate medical technologists for positions either as administrators and teachers in medical technology educational programs, or as supervisors in special areas of the clinical laboratory. The primary objective is to assist in development of knowledge in an area in administration, in education, or a special area of interest selected by the student which may be a special medical laboratory

science as the specific area applies to laboratory medicine. Specializations include clinical chemistry, clinical microbiology, hematology, and immunohematology. The specific course work requirements for the master of science degree rests with the graduate adviser in the student's specific area of interest.

Graduate Committee: Professors J. Krall, B. Love, H. Mengoli, D. Moore, Jr., N. Rodman, and S. Jagannathan.

Admission

Applicants must have a baccalaureate degree in medical technology from an accredited institution or a baccalaureate degree in an allied field and be a certified medical technologist with an acceptable certifying agency.

(Information concerning the Medical Technology undergraduate program may be found in the *WVU Medical Center Catalog*.)

The area of concentration in medical technology desired by the student is considered in the evaluation of the undergraduate record as follows:

1. Individuals who desire to do special study in clinical chemistry, hematology, or immunohematology must have completed 8 hours of physics, 3 hours of mathematics, 4 hours of organic chemistry, and 4 hours of quantitative chemistry on the college level.

2. Individuals who desire to do special study in microbiology must have completed 4 hours of organic chemistry and 16 hours of biological sciences.

3. A minimum of one year's experience in a clinical laboratory is required for admission.

Students will be required to make up deficiencies in the above, as well as other deficiencies deemed necessary by the adviser.

Applicants must have a minimum undergraduate grade-point average of 2.5 (based on A = 4.0 grade points) for admission.

All applicants to the graduate program are required to take the general aptitude part of the Graduate Record Examination. Results should be sent to the WVU Medical Technology Programs Office.

Two letters of reference must be on file in the Medical Technology Office. One letter should be from the major adviser in the undergraduate college and another from the immediate supervisor of the applicant's present position. An interview will be requested for all applicants who meet the requirements for admission.

Applicants are selected for admission on the basis of scholastic standing, recommendations, and interest in the field of medical technology. The number of applicants accepted is necessarily limited by the available facilities; and in general, applicants with the most experience are considered first.

Application Procedure

A preliminary application is filed in the Medical Technology Programs Office.

Letters of recommendation are sent to the Medical Technology Programs Office.

After approval of the preliminary application, the admission procedure is the same as for other programs in the WVU Graduate School.

A personal interview may be required before final admission to the program. This interview will give the graduate student an opportunity to evaluate the program and to determine if the program will offer the educational opportunities which the student desires.

Course of Study

It is expected that the students who enter the graduate program in medical technology will have a goal in mind and a special field of interest in medical technology. The program is tailored to the needs of the student as far as possible. A minimum of 36 semester hours of credit including a research problem is required. The student selects a major area of concentration from either education, supervision, or administration, and a minor area from clinical microbiology, clinical chemistry, clinical hematology, or immunohematology.

A minimum of 12 semester hours of course work in education, to include the following, is required of all students:

- (A). The three following courses are required:
Ed. P. 320 — Introduction to Research 3 hr.
Ed. P. 330 — Foundations of Educational Measurements 3 hr.
Ed. F. 320 — Philosophic Systems and Education 3 hr.

- (B). The student selects one of the following:
Hl. Ed. 305 — Philosophy of Health Education 3 hr.
Ed. P. 260 — Instructional Media and Technology 3 hr.
Ed. P. 360 or 361 — Instructional Systems 3 hr.
Ed. P. 450 — Psychological Foundations of Learning 3 hr.
Ed. P. 451 — Principles of Instruction 3 hr.
Ed. A. 330 — Principles of Education Leadership 3 hr.
Ed. A. 331 — Principles of Supervision 3 hr.
Ed. F. 300 — Sociology of Education 3 hr.

- (C). Ed. P. 311 (Statistical Methods), Stat. 311 (Statistical Methods), or C. Med. 311 (Biostatistics), is strongly recommended.

Other courses to complete 36 semester hours are selected by the student (with the help of the adviser) in the area of concentration selected by the student. Students may select courses in departments in schools other than the School of Medicine.

All students must complete a minimum of 18 semester hours in a science related to medical technology including Seminar (3 hr.) and Problem Study (6 hr.).

All students must rotate for orientation purposes through all sections of the University Hospital Clinical Laboratories to include microbiology, hematology, chemistry, immunohematology, and histopathology for a minimum of two days in each laboratory or a total of ten days.

In addition, at the discretion of the student's adviser, other requirements in teaching, supervision, and administration may be necessary.

The adviser works out with the student a plan of study for the entire graduate program. This plan is usually made at the end of the first semester of the student's graduate study. A copy of this "plan of study" is signed by the adviser and student and sent to the Medical Technology Office to be put in the student's file.

Examinations

A final written comprehensive examination in the major and minor interest areas is given approximately one month before the date on which the degree is to be awarded.

An oral defense of the problem is given about one month after submission of the Problem Study in its final form to the Graduate Committee.

Requirements for Degree

All requirements for the master of science degree, as outlined in the WVU *Graduate School Catalog*, must be fulfilled. These requirements can be fulfilled in three semesters of full-time work, but ordinarily at least four semesters are required for completion of the degree requirements.

Degree candidates must have a 3.0 grade-point average and must have removed all incomplete grades and deficiencies.

All students must complete a problem study (see M. Tec. 497).

Registration Requirement

Owing to the limit on the number of students who can be enrolled in the graduate program in medical technology, all students (part-time and full-time) must enroll each semester to continue in the program.

Medical Technology (M. Tec.)

300. *Seminar*. I, II, S. 1 hr. Student registers for 1 hr. each semester. Seminars include laboratory management, education in medical technology, and timely topics. Minimum of 3 hours of seminars to include all three topics is required of graduate students.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Research*. I, II, S. 1-15 hr. Student is required to pursue study on a problem in the student's area of concentration. This study is reported in a thesis-style manuscript. For this study and report, the student registers in M. Tec. 497. Total number of hours earned in M. Tec. 497 is determined by the student's adviser. As many as 9 semester hours may be taken during one semester or, by arrangement with the adviser, credit hours may be taken over several semesters. In the final compilation for degree requirements, only 6 semester hours in M. Tec. 497 will be counted toward fulfillment of the 36 required semester hours for the degree even though the student may have registered for as many as 15 hours in M. Tec. 497.

MICROBIOLOGY (Medical)

Irvin S. Snyder, Chairperson of the Department

2095-B Basic Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Burrell, Charon, Deal, Ganguly, Gerencser, Hall, Kirk, Mengoli, Olenchok, Pore, Snyder, Sorenson, Thompson, Veltri, Voelz, and Yelton.

The Department of Microbiology offers programs of study leading to the degrees Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) in Medical Microbiology. Students are given extensive training in microbiological research methodology. The program aims towards training students capable of designing and carrying out their own research programs and teaching microbiology.

Admission Requirements

Applicants should have had at least four upper-level courses in the biological sciences, two semesters of organic chemistry, two semesters of physics, and

a strong background in mathematics — including calculus — in order to be considered for admission. Applicants must submit to the Department of Microbiology a departmental application form, three letters of recommendation, and Graduate Record Examination (GRE) scores — both aptitude and advanced. In addition, transcripts and an official application for admission to the Graduate School must be sent directly to the WVU Office of Admissions and Records. Applicants for admission to a degree program should have a grade-point average of 3.0, or better, and a score of 600 or above on each of the GRE examinations. Early application is encouraged. Applicants desiring financial aid should complete their application before January 1. All applications must be completed by June 1 for fall admission. Applications for admission in the spring semester must be completed by November 1.

Program Requirements

Every student must take a two-semester sequence in basic microbiology (M. Bio. 310 and 311) and two semesters in biochemistry. Seminar is a required course for all students each semester they are in residence. All students in the department also are required to participate in teaching at least one semester a year. The remaining courses are selected by the student and the advisory committee from courses in microbiology numbered 317 or higher and from outside the department.

The Department of Microbiology also has informal noon-hour journal clubs in immunology, virology, and bacteriology and parasitology.

The Master of Science program requires 30 hours of course work, of which at least 20 must be in microbiology. Six hours must be in research. A research thesis and a final oral examination are required. A grade-point average of 3.0 must be achieved. In general, two years are needed to complete the M.S. program.

The Doctor of Philosophy program requires a dissertation representing the results of an original research investigation, and passing of qualifying and final oral examinations. Appropriate course work with a grade-point average of 3.0 is also required. Where appropriate, course work in related subjects such as calculus, physical chemistry, and statistics will be required. Three years are usually needed to complete the Ph.D. program.

For additional information, write to the Chairperson, Department of Microbiology, WVU Medical Center, Morgantown, WV 26506.

Research and Instruction

Research Areas — Pathogenic Bacteriology: mode of action of microbial products in pathogenicity; identification and classification of anaerobic microorganisms including filamentous bacteria; oral microbiology; ecology of the oral cavity; clinical microbiology. Mycology: pathobiology of medical mycoses; environmental health implications of fungal and algal toxicoses. Physiology: nutrition and metabolism of a variety of pathogenic microorganisms, growth and protein synthesis in obligate intracellular bacteria. Genetics: basic studies on the mechanisms of genetics including transfer of genetic information. Virology: basic studies on viral-tumor relationships; virus-induced antigens in transformed cells; pathogenesis of lymphocytic choriomeningitis virus. Parasitology: host-parasite relationships between helminth parasites and insects and vertebrate hosts. Electron Microscopy: cytological studies of the fine structure of

microorganisms and the influence of environment on these structures. Immunology: studies on the mechanisms of antigen-antibody reactions and the development of hypersensitivity; immunopathology of pulmonary disease; immunogenetics of lymphocytes; mechanisms of cellular immunity. Other programs: detection of environmental pollutants; effect of environmental agents on host resistance.

Microbiology (M. Bio.)

- 26. *Microbiology.* (For students in paramedical sciences.) I. 4 hr. Pathogenic microorganisms.
- 220. *Microbiology.* (For pharmacy students.) II. 4 hr. PR or Conc.: Biochemistry. Pathogenic microorganisms, including immunology and antimicrobial agents.
- 223. *Microbiology.* (For medical technology students; graduate students with consent.) II. 5 hr. PR or Conc.: Organic chemistry. Basic microbiology. Emphasis on immunology, pathogenic microorganisms, and clinical laboratory techniques.
- 224. *Parasitology.* (For medical technology students.) II. 4 hr. Study of animal parasites and disease vectors with emphasis on disease manifestations, parasite biology, and laboratory diagnosis.
- 301. *Microbiology.* (For medical students only.) I. 5-7 hr. PR: Organic chemistry, biochemistry. Detailed study of pathogenic microorganisms. Emphasis on use of microbiology in solving clinical problems.
- 302. *Microbiology.* (For dental students only.) I. 5 hr. PR: Organic chemistry. Detailed study of pathogenic microorganisms. Emphasis on oral flora.
- 310. *Structure and Activities of Microorganisms.* I. 2-7 hr. PR or Conc.: Biochemistry; consent. Structure and activities of microorganisms: their structure, metabolism, nutrition, growth, and genetics. Life cycles of a few model systems. (Students may enroll for one to three portions of the course.)
- 311. *Principles of Infection and Resistance.* II. 1-5 hr. PR or Conc.: Biochemistry; consent. Introduction to the principles of innate and acquired resistance and to the mechanism of pathogenesis of medically important microorganisms. (Students may enroll for one to five portions of the course.)
- 317. *Special Problems in Microbiology.* I, II, S. 1-7 hr. per sem. with a total of 24 hr. available.
- 327. *Parasitology.* (For graduate students.) II. 4 hr. PR: Consent. Study of animal parasites and disease vectors with emphasis on disease manifestations, parasite biology, laboratory diagnosis, and current concepts in parasitological research.
- 490. *Teaching Practicum.* I and II. 1-3 hr. PR: Consent. Supervised practices in college teaching of microbiology. (Graded as S or U.)
- 491. *Advanced Study.*
 - Pathogenic Virology.* I. 3 hr. PR: M. Bio. 310 and 311 or equiv.; consent. Pathogenesis of medically important viruses and mechanisms for their control. (Course will not be offered in 1981-82.)
 - Pathogenic Bacteriology.* II. 3 hr. PR: M. Bio. 311; consent. Pathogenic bacteriology, with an emphasis on the mechanisms of pathogenesis. Topics include microbial adherence, toxin production and mechanisms, and normal flora and disease. (Course will not be offered in 1981-82.)

Clinical Laboratory Bacteriology. I, II. 2-4 hr. PR: M. Bio. 311 or equiv.; consent. Lectures on the identification of pathogenic microorganisms with an emphasis on bacteria. The laboratory includes a rotation through the hospital clinical microbiology laboratory. Limited enrollment. (Graded as S or U.)

Microbial Genetics. I. 4 hr. PR: M. Bio. 310 or equiv.; consent. Molecular aspects of mutation, gene transfer mechanisms, genetic mapping, and genetic control using bacteria and bacteriophage systems as models.

Bacterial Physiology. II. 2 hr. PR: M. Bio. 310, biochemistry; consent. The physiology and metabolism of bacteria of medical, industrial and ecological importance.

Immunobiology. II. (Alternate Years.) 2 hr. PR: M. Bio. 311; consent. Discussion of the biological and cellular aspects of immunology. Immunobiology, immunopathology, and cellular immunology receive strong emphasis. This course is designed to complement Bioch. 491.

Medical Mycology. I. 4 hr. PR: M. Bio. 311 or equiv. Advanced study of the fungi of medical importance, including the pathobiology of mycoses and toxicoses.

Comparative Cytology. II. 4 hr. PR: Consent. Limited enrollment. Basic features in structure and function of animal, plant, and microbial cells and their organelles. Projects in electron microscopy.

Cell and Molecular Biology of Eukaryotes. II. 2-6 hr. PR: Consent. Interdepartmental team taught course. Modular approach: (1) overview and cell growth; (2) membrane structure and function; (3) tumor biology. In alternate years, the three modules offered are (1) above and (4) somatic cell genetics and chromosome structure; and (5) hormone action and gene expression.

Tumor Virology. II. 3 hr. PR: Biol. 315 or equiv.; consent. A consideration of the molecular and biochemical aspects of viruses which cause tumors and the mechanisms by which they cause cellular transformation. (Course will not be offered in 1981-82.)

Clinical Laboratory Virology. S. 3 hr. per 6-week session. PR: Consent. Lectures and laboratories on isolation of viruses from clinical specimens. Includes serological methods.

496. Seminar. I, II. 1 hr. PR: M. Bio. 310 or equiv. (Graded as S or U).

497. Research. I, II, S. 1-15 hr. PR: M. Bio. 310 or equiv. Students may enroll more than once. (Graded as S or U.)

MINERAL AND ENERGY RESOURCES

Mineral Resource Economics Option —

Richard T. Newcomb, *Chairperson, Department of Mineral Resource Economics*
214 White Hall

Mineral Processing Engineering Option —

Kenneth K. Humphreys, *Chairperson, Department of Mineral Processing Engineering*
220 White Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Mineral Resource Economics — Members Newcomb, Katell, Labys, and Miernyk; Mineral Processing Engineering — Members Humphreys and Muter. Associate Member Cho.

Master of Science (M.S.)

The College of Mineral and Energy Resources (COMER) offers graduate curricula leading to the degrees of Master of Science in mineral processing engineering and mineral resource economics.

A student desiring to take courses for graduate credit at the master's level in the College of Mineral and Energy Resources must first apply for admission to the Graduate School and state the major field.

An applicant with a baccalaureate degree, or its equivalent in the major field corresponding to the graduate study desired, will be admitted on the same basis as graduates of WVU. Lacking these qualifications, the applicant must first fulfill the College of Mineral and Energy Resources requirements in the field in which the student is seeking an advanced degree.

Academic Standards. Each student will, with the approval of the student's graduate committee — appointed with the consent of the student within the first semester of registration — follow a planned program. The program contains a minimum of 24 hours of course work and 6 hours of independent and original study in the minerals field leading to a master's thesis. At least 60 percent (18 hours) of the course credits must be from 300-level or 400-level courses while the remainder can be made up of 200-level courses.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

No credits are acceptable toward an advanced degree which are reported with a grade lower than C. To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0 based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing independent, original study in the minerals field.

Doctor of Philosophy (Ph.D.)

The College of Mineral and Energy Resources (COMER) offers graduate curricula leading to the degree of Doctor of Philosophy (Ph.D.) in mineral processing engineering and mineral resource economics.

A Ph.D. degree in Mineral and Energy Resources (MER) is available for candidates seeking the option in Mineral Resource Economics. The degree prepares students with engineering, earth science or physical science degrees at the baccalaureate or master's level for careers with research institutes, industry, and state and national agencies concerned with mineral and energy resource use, the technical management of mining, petroleum, and natural gas firms and for leadership roles in the area of mineral economics.

A Ph.D. degree in Mineral Processing Engineering can also be earned utilizing the multidisciplinary engineering Ph.D. under the control of the Graduate School. A student desiring to take courses for graduate credit in the College of Mineral and Energy Resources must first apply for admission to the Graduate School and state the major field. For information concerning applications and requirements for the interdisciplinary Ph.D. program, see the interdisciplinary Ph.D. program under College of Engineering.

Mineral Resources (M.E.R.)

200. *Mineral Resource Conservation.* I. 3 hr. PR: Junior standing. The economics of conservation for nonrenewable resources; traditional and modern views; new environmental concerns; problems of regulation. An introduction to cost benefit analysis and to national energy and mineral policy.

210. *The Economics of the Mineral Industries. II.* 3 hr. Analyzes for the nonfuels resources availabilities, market structure, characteristics, and long-run demands. Regional impacts are considered as these relate to national mineral policies and environmental controls. 3 hr. lec.
222. *Energy Economics. I.* 3 hr. Analyzes energy sector of the economy, inter-fuel competition, current and future markets, and international trade. New energy technologies. 3 hr. lec.
300. *Minerals Technology Forecasting. I, II.* 3 hr. PR: Consent. Introduction and review of techniques used for forecasting minerals technology. Detailed basic principles. Intended for users and evaluators of these techniques.
301. *Minerals Technology Assessment. I, II.* 3 hr. PR: Consent. Introduce and review those methods applied to the systematic study of the effects on society that may occur when a mineral technology is introduced, extended, or modified.
310. *Advanced Hydrometallurgy. I.* 3 hr. PR: M.P.E. 221 or consent. Advanced concepts of hydrometallurgy. Recent technology of leaching, concentration, recovery of metal and mineral values, various mechanisms of leaching of minerals. Techniques such as continuous ion exchange, thermal precipitation, and current electrolytic technology.
317. *Advanced Coal Preparation. II.* 3 hr. PR: M.P.E. 217 or consent. The origin and distribution of mineral matter in coal including specific gravity distributions. Fine grinding and beneficiation by flotation technology. Coke blending, solid waste disposal, and advanced plant design.
318. *Advanced Mineral Processing. II.* 3 hr. PR: M.P.E. 219, 220, or consent. Advanced surface phenomena techniques including rigorous treatment of electrokinetic measurements and applications. Advanced concepts of collector adsorption on minerals and flotation response. Recent developments in solvent extraction and cementation including solution.
320. *Design of Mineral Beneficiation Operations. I.* 4 hr. PR: Consent. Advanced problems in coal and mineral processing for the mature student using an extensive technical background. 1 hr. lec., 9 hr. lab.
324. *Advanced Special Topics. I and II.* 1-6 hr. PR: Consent. Special advanced problems in mineral process engineering including choices among topics related to coal preparation, conversion, and process metallurgy.
326. *Advanced Particle Characterization. II.* 3 hr. PR: M.P.E. 226 or consent. Extension of work in M.P.E. 226 with greater emphasis on advanced methods of analysis.
350. *Readings in Mineral Resource and Energy Economics. I, II.* 3 hr. Review of current mineral economic studies. Selected authors in mineral science and engineering, the economics of natural resource exploitation and environmental control, national mineral policy, world mineral development and trade. 1 hr. lec. and independent study.
351. *Mineral Resource Appraisal and Exploration Decisions. II.* 3 hr. Introduces appraisal techniques for mineral resources including spatial models of occurrence and geostatistical models. Relation of changes in infrastructure market demands to the value of regional resources. 3 hr. lec.
355. *Advanced Regional Energy Economics 1. I.* 3 hr. Advanced location theory; development of regional income and product accounts. Construction of regional and inter-regional input-output, dynamic and other models. Application to a variety of regional and interregional energy and resource problems.
359. *Advanced Regional Energy Economics 2. II.* 3 hr. Regional and interregional growth theory. Impacts of changing energy and resource prices on regional and inter-

regional economic development. Regional economic development policy in the U.S. and selected foreign countries.

- 381. *Theory and Policy of Mineral Economics*. II. 3 hr. Defines the pure theory of resources and energy allocation with technologic, geologic, and environmental constraints. A general model is presented with partial and special applications for major problem areas: resource valuation, conservation, exhaustion, taxation, and trade. Problems of imperfect competition and monopoly open consideration to the foundations of policy in practice and theory. 3 hr. lec.
- 392. *The Economics of the Energy and Petrochemical Sectors*. I. 3 hr. PR: Consent. Energy and petrochemical complexes are defined within an open activity analysis model. The problems explored include forecasting energy demands, joint production and costing, environmental controls, and impacts on regional and international trade. 3 hr. lec.
- 394. *Special Topics in Mineral Economics*. I, II. 6 hr. PR: Consent. Selected economic problems in petroleum and natural gas engineering and the mineral industries. 3 hr. lec.
- 398. *Models of Mineral Commodity Markets and Industries*. II. 3 hr. Econometric studies analyzing the behavior and problems of selected mineral industries and commodities from the viewpoint of the firm, industry, and region of interest. Applications include programming techniques. 3 hr. lec.
- 440. *The Economics of the Coal Industry*. I. 3 hr. Economic analysis of coal markets under current and proposed technological and environmental constraints. Applications include conversion products and production techniques.
- 472. *Resources in Trade and Development*. II. 3 hr. PR: Econ. 211, 212; Econ. 250 recommended. Analyzes the role of resource commodities in international trade, including their impact on developing exporting countries. Also considered are strategic analyses of current international commodity problems, commodity trade and development issues, and related policy formulation.
- 491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
- 495. *Graduate Seminar*. I, II. 1-4 hr. PR: Consent.
- 497. *Graduate Research*. I, II. 1-4 hr. PR: Consent.

Mineral Processing Engineering (M.P.E.)

- 217. *Coal Preparation*. I, II. 3 hr. PR: Consent. Formation of coal, rank classification of coal, coal petrography, principles of preparing and beneficiating coal for market with laboratory devoted to sampling, screen analysis, float and sink separation, and use of various types of coal cleaning equipment. 2 hr. lec., 3 hr. lab.
- 218. *Advanced Mineral Processing*. II. 4 hr. PR: M.P.E. 217. Application of particle characterization, particle behavior in fluids, industrial sizing and size reduction fluid-solid separations are discussed. Introduction to froth flotation, and magnetic and electrostatic separation for the concentration of minerals is described. 3 hr. lec., 1 hr. lab.
- 219. *Surface and Interfaces*. I. 3 hr. PR: M.P.E. 218. The study of surface tension phenomena, surface thermodynamics, electrical double layer polarized and non-polarized electrodes, insoluble monolayers, adsorption phenomena and colloidal foams and emulsion consideration as applied to mineral surfaces.
- 220. *Mineral Flotation*. II. 4 hr. PR or Conc.: M.P.E. 219. The application of surface phenomena for the beneficiation of minerals, including naturally hydrophobic, in-

soluble oxides, semi-soluble and soluble minerals. Activation and depression of sulfide minerals. Engineering and design of flotation circuits.

221. *Hydrometallurgy*. I. 4 hr. PR: Consent. Introduction to electrochemical aspects and rates of solid-liquid reactions as applied to leaching, concentration and recovery of minerals. Discussion of solvent extraction, ion exchange, electrowinning, and other current industrial processes.
222. *Rate Phenomena in Extractive Metallurgy*. I. 3 hr. PR: A.E. 114 (or concurrent); Chem. 141, 142. Momentum, heat and mass transfer phenomena theory, concepts of boundary layers and techniques of process analysis as applied to metallurgical reaction systems.
224. *Mineral Problems*. I, II. 1-6 hr. PR: Senior or graduate standing or consent. Special problems considered in minerals beneficiation and processing, including choices among design and research projects in coal preparation, coal conversion, (process) hydro- and extractive metallurgy or minerals economy.
250. *Control Systems in Mineral Processing*. II. 3 hr. PR: Junior standing in mineral processing engineering. The instrumentation and automatic control systems used in today's mineral processing technology are studied not only to cover data recording and control but also to learn process optimization. 3 hr. lec.
270. *Design and Synthesis*. I, II. 3 hr. PR: M.P.E. 217, I.E. 281. The logic and quantitative tools required for synthesizing mineral processing systems are used on a realistic problem by students working independently. Specific attention on economic and environmental implications. 3 hr. lec.

MINING ENGINEERING

Syd S. Peng, Chairperson of the Department
112 White Hall

Degrees Offered: M.S.E.M., Ph.D.

Graduate Faculty: Members Adler, Kelley, Leonard, Peng, Rollins, Sandy, and Wang.
Associate Members Bondurant and Park.

Master of Science in Engineering of Mines (M.S.E.M.)

A student desiring to take courses for graduate credit at the master's level in the College of Mineral and Energy Resources must first apply for admission to the Graduate School and state the major field.

An applicant with a baccalaureate degree in mining engineering will be admitted on the same basis as graduates of WVU. Lacking these qualifications, the applicant must first fulfill the requirements of the Department of Mining Engineering.

Academic Standards. Each student will, with the approval of the student's graduate committee — appointed with the consent of the student within the first semester of registration — follow a planned program. The program contains a minimum of 24 hours of course work and 6 hours of independent and original study in mining engineering leading to a master's thesis. At least 60 percent of the course credits must be from 300-level or 400-level courses while the remainder can be made up of 200-level courses.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

No credits are acceptable toward an advanced degree which are reported with a grade lower than C. To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0, based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing independent, original study in mining engineering.

Doctor of Philosophy (Ph.D.)

A Ph.D. degree in Engineering of Mines can also be earned utilizing the multidisciplinary engineering Ph.D. under the control of the Graduate School. A student desiring to take courses for graduate credit in the College of Mineral and Energy Resources must first apply for admission to the Graduate School and state the major field. For information concerning applications and requirements for the interdisciplinary Ph.D. program, see the interdisciplinary Ph.D. program under College of Engineering.

Engineering of Mines (E.M.)

- 201. *Fire Control Engineering*. II. 3-4 hr. PR: Senior standing in an engineering curriculum or consent. Aspects involved in the control from fire, explosion, and other related hazards. Protective considerations in building design and construction. Fire and explosive protection organization including fire detection and control. Lectures (3) and/or 3 hr. lab.
- 212. *Advanced Mining*. I, II. 3 hr. PR: E.M. 108; PR or Conc.: E.E. 105. Engineering principles, methods, and equipment applied to mine transportation, hoisting, and drainage. 3 hr. lec.
- 213. *Mine Ventilation*. I, II. 3 hr. PR: E.M. 108, M.E.M. 42, C.E. 115. Engineering principles, purposes, methods, and equipment applied to the ventilation of mines. 2 hr. lec., 3 hr. lab.
- 215. *Industrial Safety Engineering*. II. 3 hr. PR: Junior standing or consent. Problems of industrial safety and accident prevention, laws pertaining to industrial safety and health, compensation plans and laws, and industrial property protection. 2 hr. lec.
- 216. *Mine Safety Engineering*. I. 3 hr. PR: E.M. 108 and E.M. 215. Analysis and application of mining health and safety laws to the work processes of the mining industry.
- 219. *Advanced Mining Methods for Vein Deposits*. II. 3 hr. PR: E.M. 108. Methods and systems of mining other than flat seams. Emphasis on selection of methods in relation to cohesive strength of ore bodies and their enclosing wall rocks. Mining of anthracite included. 3 hr. lec.
- 220. *Mine Design*. I, II, S. 3 hr. PR: E.M. 212, 213, 241, and senior standing. Comprehensive design problem involving underground mining developments or surface plant or both, as elected by the student in consultation with instructor. Preparation of a complete report on the problem required, including drawings, specifications, and cost analysis. 9 hr. lab.
- 221. *Mine Design*. II. 2 hr. PR: E.M. 212, 213, 241. Design principles and methods pertaining to mine water treatment, refuse disposal and treatment, dust control systems, reclamation and revegetation. 6 hr. lab.
- 222. *Mine Equipment and Machinery*. I, II. 3 hr. PR: E.E. 105, E.M. 212. Selection, installation, operation, and maintenance of mining equipment. 3 hr. lec.
- 223. *Mine Management*. II. 3 hr. PR: Math. 18, E.M. 108, 212, and senior standing. Economic, governmental, social, and cost and labor aspects of mining as related to the management of a mining enterprise. 3 hr. lec.

224. *Mining Engineering Problems*. I, II. 1-6 hr. PR: Senior or graduate standing or consent. Special problems in mining engineering, including choices among operations research, mine systems analysis, coal and mineral preparation, and coal science and technology.
228. *Mine Equipment and Machinery Controls*. I. 3 hr. PR: E.M. 222 or consent. Principles, application, and use of electric and hydraulic devices and circuits for protection and control of mine machinery and equipment. 3 hr. lec.
229. *Advanced Mining Equipment Applications*. II. 3 hr. PR: E.M. 228. Structural, mechanical, hydraulic, and electrical characteristics of the more common items of mining equipment. Controls, electrical and hydraulic circuits, and mechanical transmissions with associated problems. Laboratory design of a control system for a mining machine. 2 hr. lec., 3 hr. lab.
234. *Applied Geophysics*. II. 3 hr. PR: Phys. 12 and Geol. 151 or consent. Origin of the universe and the planets, heat and age of the earth. Application of the science of geophysics in the location of analysis of earthquakes and in prospecting for oil and minerals.
241. *Mechanics of Ground Control in Mines*. I and II. 3 hr. PR: E.M. 108, M.E.M. 42 or consent. Rock properties and behavior, in situ stress field, mine layout and geological effects: designs of entry and pillar and roof bolting, convergence of openings and surface subsidence engineering. 1 hr. lab.
247. *Explosives Engineering*. I. 3 hr. PR: Chem. 16, M.E.M. 43. Theory and application of explosives, composition properties and characteristics of explosives, blasting design fundamentals, legal and safety considerations. 3 hr. lec.
249. *Rock Mechanics*. II. 3 hr. PR: M.E.M. 43 or consent. Elastic and plastic properties of rock, Mohr's criteria of failure, elastic theory, stress distribution around underground openings, open pit and underground stability rock testing techniques. 2 hr. lec., 1 hr. lab.
290. *Surface Mining*. II. 3 hr. PR: E.M. 108, Geol. 151, M.E.M. 43, or consent. Open pit mining, quarrying, and stripping, with emphasis on planning, production, and equipment systems. 3 hr. lec.
- 301, 302. *Advanced Mine Design*. I, II. Credit arranged. Advanced detail design and layout of coal mine plant, particularly incorporating new ideas of machines and mining methods.
307. *Explosive Engineering Design*. II. 3 hr. PR: E.M. 247 or consent. Rock drilling, total blast systems simulation, experimental studies in blast design, rock fracturing, chemical thermodynamics, kinetics, and reaction rates. 3 hr. lec.
311. *Advanced Ground Control — Coal Mines*. I. 3 hr. PR: E.M. 241 or consent. Ground and strata control for underground and surface coal mining, including slope stability and subsidence.
316. *Advanced Rock Mechanics*. II. 3 hr. PR: E.M. 249 or consent. Testing techniques and interpretation, strength and fracture, classification, anisotropy, friction, jointed rock, fluid pressure, fragmentation, and excavation.
320. *Mobile Excavating and Materials Handling*. I. 3 hr. PR: Graduate standing and consent. Mobile mining equipment will be systematically analyzed as to functional, production, failure, and operational aspects. Included will be routine and innovative methods, and surface and underground applications, such as the hydraulic shovel and impactors.
321. *Integrated Excavating and Materials Handling*. II. 3 hr. PR: Graduate standing and consent. Integrated mining equipment will be systematically analyzed as to functional, production, failure, and operational aspects. Included will be routine and in-

novative methods, and surface and underground applications, such as the longwalls and monorails.

- 331. *Mine Ventilation Network Analysis*. I, II. 3 hr. PR: E.M. 213, I.E. 281, or consent. Theory and computational techniques for mine ventilation network problems with emphasis on computer-aided analysis of complex mine ventilation systems.
- 351. *Coal Mining*. S. 3 hr. PR: Chemistry, 10 hr.; physics, 8 hr.; and accompanied or preceded by general geology. Especially for students who are planning to teach mining subjects in high school. Not open to students taking E.M. 108 or 212.
- 365. *Advanced Deterministic Methods for Mineral Engineers*. I. 3 hr. Analysis and solution of mineral engineering problems which require use of deterministic models. Application of deterministic methods to mineral transportation, mineral resource allocation and extraction problems, and mine planning and equipment utilization problems. 3 hr. lec.
- 366. *Advanced Stochastic Methods for Mineral Engineers*. II. 3 hr. Application of stochastic methods to mineral engineering problems in equipment selection, renewal processes, mine ventilation, mine production, and mineral extraction. 3 hr. lec.
- 395, 396. *Graduate Seminar in Coal Mine Operation and Administration*. I, II. 3-6 hr. PR: B.S. degree and consent of committee. Problems related to production, preparation, marketing, and utilization of coal, with special assignments and emphasis in accordance with personal background and field of interest of student.
- 407. *Theory of High Explosives*. II. 3 hr. PR: E.M. 307 or consent. The application of chemical thermodynamics and the hydrodynamic theory to determine properties of high explosives, chemical equilibria, and calculation of detonation and explosion-state variables.
- 496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and graduate student body of the student's program.
- 497. *Research*. I, II. 1-15 hr.
- 499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use the University's facilities, and participate in its academic and cultural programs.

MUSIC

Cecil B. Wilson, Chairperson of the Division of Music

Degrees Offered: M.M., D.M.A., Ph.D.

Graduate Faculty: Members Beall, Brown, J. Crain, Eckhoff, Elzinga, Godes, Horacek, Hudson, Lefkoff, F. Lorince, Miltenberger, Portnoy, Schafer, Trythall, and Wilson.
Associate Members D. S. Baker, Benner, R. Crain, Faini, Swartwout, and Wilkinson.

Prospective graduate students in music are required to have completed the appropriate curriculum of undergraduate study in music at WVU, or its equivalent at another institution of recognized standing. For acceptance into a degree program the applicant must:

1. For the Master of Music degree, have an average of 2.5 on all undergraduate study; for the Ph.D. and Doctor of Musical Arts, have an average of 3.0 on the Master's degree or equivalent.

2. Submit to the Division of Music a score of at least 35 on the Miller Analogies Test.

3. Demonstrate by audition or a tape recording a level of attainment on the major instrument no more than one grade-level below the stated entrance level as indicated for the respective curriculum. Performance proficiency, based on technical ability, repertoire, and musicianship, is graded on a scale from Level 1 to Level 10. A listing of representative material by Level for each performance area is available from the Division of Music.

The audition for acceptance as a degree student will be assessed in a preliminary manner for admission purposes. The estimated proficiency level must be confirmed by a jury examination at the end of the first semester of applied study. Credit in Applied Music at the 400 level will count toward degree requirements only when the appropriate proficiency level prerequisite has been reached.

Evidence of previous teaching or professional experience is desirable in the consideration of doctoral applicants.

Applicants accepted for degree study must take entrance tests in theory and music history, and audition on piano. These tests and auditions will be given two days before registration. The results of these might indicate the need for remedial study. Applicants for the areas of Theory and Composition will be tested more specifically in counterpoint (both sixteenth and eighteenth century), form, instrumentation, and orchestration. Applicants seeking acceptance as composition majors also must submit representative compositions for evaluation and approval.

Applicants who have been admitted to the Graduate School, but whose averages and test scores do not meet the qualifications outlined above, will be accepted as Special Provisional Students. If, upon completion of at least 9 semester hours of graduate study they have maintained a B (3.0) average, and when any previous undergraduate deficiencies are removed, such students may petition to be accepted as degree students.

The Miller Analogies Test may be taken at any time by appointment at numerous college testing centers around the country. (The Division of Music can supply addresses upon request.) If a tape recording is submitted, it must be of a high quality, 7½ ips, and clearly marked as to name, titles of compositions, and types of tracks used (i.e., half track, quarter track mono, quarter track stereo, etc.). The best recordings still leave much to be desired and a personal audition is encouraged if at all feasible. The auditions are administered on Saturdays on announced dates throughout the school year and summer. These dates are available upon request. For each semester or the summer the last date is approximately six weeks before registration.

Master of Music (M.M.)

Candidates must establish an overall grade-point average of 3.0 within a maximum of 36 hours. Applicants will be admitted to candidacy upon the completion of 12 semester hours of graduate study. No student will be admitted to candidacy until the student has removed all undergraduate deficiencies and maintained a 3.0 average in all graduate work completed.

Candidates for the Master of Music degree may major in one of five fields: Music Education, Applied Music, Theory, Composition, and History of Music.

Graduate students majoring in Music Education will be allowed one of four options, to be determined in consultation with the adviser: (1) Thesis option; (2) Recital option (if the candidate demonstrates at least grade level of 8½ ability in the candidate's major performance area when entering); (3) Thirty-six hour

option; and (4) Certification option (intended for persons possessing a bachelor's degree with a major in music), leading to eligibility for certification for teaching grades K-12 in the public schools of West Virginia. For the first three options there are the following requirements:

1. Thirty graduate hours for thesis and recital options, 36 graduate hours otherwise with an average of 3.0.

2. Required courses: Music 400 (major performance area); 12 hours of graduate Music Education courses; one course each in the areas of theory and music history.

3. Achievement of Level 8 on the major instrument or demonstration of comparable musicianship. Approval for modes of demonstration other than performance on the major instrument, such as conducting, or other skills important to successful teaching must be sought at the outset of the program.

4. Demonstration of the ability to integrate music history, music theory, and music education by passing comprehensive written and oral examinations.

5. Successful completion of a 4-credit-hour thesis or 2-credit-hour recital for the thesis and recital options, respectively.

For the certification option, a special selection of approximately 24 hours is made in cooperation with the College of Human Resources and Education to satisfy certification requirements. The other hours, for a total of 36, are electives to provide a good background for teaching. Undergraduate courses may be required to make up deficiencies in areas of performance or conducting.

Music Education

Hr.

(PR: Level 2 in piano; level 7 in the major performance area or as appropriate to the option chosen.)

Music Education courses at the 300 or 400 level*	12
Music 343 — Contemporary Techniques in Classroom Music	3
Music 344 — Appalachian Music for the Classroom	3
Music 346 — Musicmaking for Middle School-	
Junior High Students	3
Music 440 — Choral Techniques	2
Music 442 — Instrumental Techniques	2
Music 444 — Music Education	3
Music 446 — Introduction to Research in Music Education	3
Music 448 — Psychology of Music Learning	3
Music 449 — Psychology of Music	3
One Theory course and one Music History course	5-6
For Thesis Option:	
Music 400 — Applied Music (major performance area)	4
Music 497 — Research (Thesis)	4
Electives	4-5
For Recital Option:	
Music 400 — Applied Music (major performance area)	6
Music 493 — Recital	2
Electives	4-5
For 36-hour Option	
Music 400 — Applied Music (major performance area)	4
Electives	14-15
Totals	30 or 36

*Students in the Thesis option must include Music 446.

History of Music

Hr.

(PR: Level 7 in the major performance area; Level 3 on piano; 4 semesters of a foreign language; 12 undergraduate hr. in Music History.)

Music 430 — Introduction to Musical Bibliography	3
Music History, chosen from Music 221-225	6
Music 491 — Special Topics	6
Theory Elective	3
Music 497 — Research (Thesis).	4
Electives*	8
Total	30

Applied Music

Hr.

(PR: Level 10 in the major performance area; Level 3 on piano (Level 5 for organists); for Voice, the same requirement covering French, German, and Italian as that for the B.M. degree in Voice.)

Music 400 — Applied Music (major performance area)	8
Music 430 — Introduction to Musical Bibliography	3
One of the following courses:	2
Music 496 — Lecture Recital	2
Music 497 — Research	2
Music 498 — Recital	4
Music electives (to include at least one Theory course and one Music History course; no more than 4 hr. in the major performance area)	13
Total	30

Composition

Hr.

(PR: Level 8 in the major performance area; Level 4 on piano; evaluation of previous compositions at the graduate major level.)

Graduate Music History	3
Music 430 — Introduction to Musical Bibliography	3
Music 460 — Composition	6
Music 470 — Orchestration	2
Music 475 — Pedagogy of Theory	3
Music 483 — Theory Topics	3
Music 497 — Research (Thesis).	4
Electives	6
Total	30

Theory

Hr.

(PR: Level 8 in the major performances area; Level 4 on piano)

Music 430 — Introduction to Musical Bibliography	3
Graduate Music History	3
Music 470 — Orchestration	2
Music 475 — Pedagogy of Theory	3
Music 483 — Theory Topics	3
Music 497 — Research (Thesis).	4
Electives	12
Total	30

*To be eligible for graduation the candidate must demonstrate completion of Level 8 on the major instrument.

A representative public recital is required of candidates majoring in Applied Music. Composition majors must submit as a thesis a composition in a large form.

All candidates for the Master of Music degree are required to participate at least two clock hours per week for two semesters (or summer sessions) in a performing group selected with the adviser's approval.

A general comprehensive oral examination must be passed by all candidates for the Master of Music degree. Candidates may repeat this examination after a three-month period. The results of the second oral examination will normally be considered final. The examining committee will decide immediately after an unsuccessful second attempt whether a petition for a third attempt will be granted.

Doctor of Philosophy (Ph.D.)

Admission. Acceptance to the doctoral programs is competitive, and will be decided on each year in the spring, for entrance the following fall. Applicants to the program leading to the degree of Doctor of Philosophy must present necessary credentials for evaluation of previous training and experience to the Division of Music. These include a score on the Miller Analogies Test, a transcript of all grades submitted through the WVU Office of Admissions and Records, and evidence that the applicant has had a minimum of 28 semester-hours in liberal arts studies. Before admission to the program the division may, at its discretion, require the applicant to take entrance tests in various fields of music, or it may require the applicant to be present for a personal interview. Under normal circumstances the applicant must have attained an average grade of B in courses taken for the master's degree. However, if sufficient professional experience should warrant, the division may waive the requirement of a B average or may grant an applicant conditional admittance subject to the satisfactory completion of certain specified courses or the attainment of a specified grade-point average within a semester's work.

Fields of Specialization. Applicants shall select a program within one of the following fields of specialization: (1) Theory; (2) Music Education; or (3) Musicology. In addition, a minor field consisting of a minimum of 12 credit hours in another field of music or a cognate field will be required and will be chosen with the adviser's approval. If the applicant's specialization is in Musicology, the minor will ordinarily be chosen from an appropriate area of humanities.

Curriculum. The exact amount and nature of course work undertaken will be determined by the adviser with the approval of the doctoral committee in the light of the applicant's previous preparation and the field of specialization. The applicant is expected to take Music 494 — Doctoral Seminar — three times. Whatever preparatory courses are needed must necessarily be taken early in the course of study (e.g. languages, statistics, bibliography, etc.).

Candidacy. Students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are (in order of occurrence):

1. Demonstrate the ability to read German and French (only one of the two for applicants in Music Education). (Upon recommendation of the adviser and with the approval of the Dean of the Graduate School, a different Romance language may be substituted for French.)

2. Pass written qualifying examinations satisfactorily to show:
 - a. Broad knowledge in Theory and Music History and Literature.
 - b. Where appropriate, detailed knowledge in the minor field.
 - c. Knowledge in depth in the field of specialization.
3. Pass satisfactorily a comprehensive oral qualifying examination.
4. Present and have accepted an outline and prospectus of the dissertation. The requirement for doctoral seminars must be completed before the presentation of the prospectus.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. The qualifying examinations, following after satisfaction of the language requirement, shall be considered as one integral (composite) examination consisting of the written and oral parts. The applicant's doctoral committee will assess the written and oral parts within the composite whole. If an applicant does not pass the examination the applicant will be allowed to attempt the entire examination a second time. The second attempt will be considered final. However, the applicant's committee may elect to discourage a second attempt if the first does not indicate probable success upon repetition.

Residence. In general, the requirements for the degree of Doctor of Philosophy contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at WVU beyond the master's degree or its equivalent.

Dissertation. The candidate must submit a dissertation produced at WVU under the direction of a major professor which demonstrates a high order of independent scholarship, originality, competence in research, and an original contribution to the field of specialization.

Final Examination. If the candidate's dissertation is approved and the candidate has fulfilled all other requirements, the candidate will be admitted to the final oral examination before the candidate's doctoral committee. However, a final examination will not be given in the same semester as the qualifying examination. At the option of the student's committee, a written examination may also be required. The final examination(s) shall be concerned with the dissertation, its contribution to knowledge, its relation to other fields, and the candidate's grasp of the field of specialization.

Time Limitation. Requirements for the degree of Doctor of Philosophy must be completed within seven years.

Doctor of Musical Arts in: Performance and Literature; Composition (D.M.A.)

Admission. Acceptance to the doctoral programs is competitive, and will be decided on each year in the spring for entrance the following fall. Applicants to the program leading to the degree of Doctor of Musical Arts (D.M.A.) must present necessary credentials for evaluation of previous training and experience. This includes a transcript of all previous grades (submitted through the WVU Office of Admissions and Records) which must show proof that the applicant has had a minimum of 28 semester hours in liberal arts studies. A score on the Miller Analogies Test must be submitted to the Division of Music. To be admitted to the program the applicant must have attained an average grade of B in courses taken for the applicant's master's degree.

For performance, copies of programs of recent major recitals must be submitted. The applicant must be approved for the program by an audition commit-

tee, by giving evidence of superior performance, artistic maturity, and extensive repertoire as specified under Graduate Applied Music Requirements. The audition committee includes the Chairperson of the Division of Music, the Graduate Adviser in Applied Music, and the major professors involved with the degree.

For composition, the applicant must be approved for the program by an evaluation committee on the basis of scores presented of the applicant's works, accompanied by recordings if possible, which will show a successful handling of various forms and media and indicate the capacity to attain professional standing in the applicant's field.

Fields of Specialization. The degree of Doctor of Musical Arts is offered in the area of Performance and Literature in the fields of specialization of: (1) Piano, (2) Voice, and (3) Organ, and in Composition.

Curriculum. The exact amount and nature of course work to be undertaken by an applicant will be determined by the adviser with the approval of the doctoral committee in the light of the applicant's previous preparation and field of specialization.

Candidacy. Graduate students meeting the requirements of the Division of Music and general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are (in order of occurrence):

1. Demonstrate minimal acquaintance with German and French by the completion of German 2 and French 2 (or their equivalents) with a grade of C or better. (Students may petition to substitute Italian or Spanish for French.)
2. Pass written qualifying examinations satisfactorily to show:
 - a. Broad knowledge in Theory and Music History and Literature.
 - b. Knowledge in depth: (1) in the literature of the field of specialization or (2) composition.
3. Pass satisfactorily a comprehensive oral qualifying examination.
4. Present a public recital (performance specialization only).

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. The qualifying examinations, after fulfilling the language requirement, are considered as one integral (composite) examination consisting of the written and oral parts. The applicant's doctoral committee will assess the written and oral parts within the composite whole. If an applicant does not pass the examination the applicant will be allowed to attempt the entire examination a second time. The second attempt will be considered final. However, the committee may elect to discourage a second attempt if the first does not indicate probable success upon repetition.

Residence. In general, the requirements for the degree of Doctor of Musical Arts contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at WVU beyond the master's degree or its equivalent.

Recitals, Performance, and Research (Performance specialization only). Recital, performance, and research requirements should be the equivalent to approximately 20 credit hours. A prospectus indicating the various performances and/or projects to be presented for the satisfaction of these requirements will be drawn up by the candidate with the help of the candidate's major professor, and submitted to the candidate's doctoral committee for approval. (Approximate recital credit equivalents to be established by the candidate's committee are: solo recital, 3-5; written research project, 2-4; program accompaniment,

1-2; concerto, major oratorio role, 2.) This prospectus should display a variety of kinds of music and types of presentations appropriate for the preparation of an artist-teacher, and may include solo recitals, lecture recitals, chamber music programs, concerto performances, major roles in opera or oratorio, major accompaniments, or written research projects. It would include at least two solo recitals and normally will include either a research project or a lecture recital. Approximately one-half of the 20-credit bloc must be earned after admission to candidacy.

Compositions and Research (Composition specialization only). Composition and research requirements should be equivalent to approximately 20 credit hours. "Equivalent credit" will be assigned by the student's doctoral committee on the basis of four to seven credits for a major work (symphony, opera, etc.) and fewer credits for lesser works. Credits may be assigned both on a qualitative and a quantitative basis. Proposed works will be approved by the committee to insure that sufficient variety and breadth of compositional experience is included. Normally, at least one major work and one written paper will be required. The latter will be a research paper, generally an analysis of some aspect of twentieth-century composition, and will be assessed at 2-4 credit hours.

Final Examination (Performance specialization only). The final examination will consist of a major solo recital (which will be regarded as the equivalent of the Ph.D. dissertation defense). Immediately following the public performance the candidate's committee will meet to evaluate the performance as evidence of mature musicianship and finished technique. Such a final examination recital will not be given in the same semester as the qualifying examination.

Final Examination (Composition specialization only). If the candidate's compositions and project are approved and the candidate has fulfilled all other requirements, the candidate will be admitted to the final oral examination before the candidate's doctoral committee. At the option of the candidate's committee, a written examination also may be required. The final examination(s) shall be concerned with the compositions, the project (if any), and the candidate's grasp of the field of specialization and its relation to other fields. The final examination will not be given in the same semester as the qualifying examination.

Time Limitation. Requirements for the degree of Doctor of Musical Arts must be completed within seven years.

Doctor of Education (Ed.D.)

The degree of Doctor of Education (Ed.D.) is offered in cooperation with the College of Human Resources and Education. The sequence of prerequisites to admission, prerequisites to candidacy, and requirements for the degree are set forth in the College of Human Resources and Education section of the *Graduate School Catalog*. The requirements for the degree of Doctor of Education for students in Music are identical with those for students in Education.

Music (Music)

Applied Music

210. *Piano Class Methods and Materials.* I. 3 hr. Methods, materials, and pedagogical techniques, including presentation of keyboard theory as used in functional piano. Practical organization of piano classes. Laboratory: Observation of experienced class teacher and student teaching.

212. *History of Keyboard Pedagogy and Technic.* II. 3 hr. Study of keyboard development and technique, including pedagogical works of the eighteenth through twentieth centuries and application to specific teaching problems. Laboratory: Student teaching and observation, emphasizing analysis and solution of technical problems. (Course will not be offered in 1981-82.)
218. *Repertoire.* I. 0-2 hr.
219. *Repertoire.* II. 0-2 hr.
310. *Secondary Applied Music.* I, II, S. 1 hr. (May be repeated for credit.) Group or individual instruction in performance on a minor instrument (or voice), with emphasis on methods and materials for school music teachers.
400. *Applied Music.* I, II. 1-4 hr. (Open to qualified students in any field in Applied Music. May be repeated.) A student must demonstrate ability of grade-level 4 on an instrument to receive credit in Music 400 on that instrument. Students other than music majors may take a maximum of one 30-minute lesson per week. If such students demonstrate ability of grade-level 7, this may be at 2 credits; otherwise, the maximum for such students is 1 credit.
409. *Master Class in Applied Repertoire.* I, II. 2 hr. (May be repeated for credit.) PR: Consent. Designed to give coverage through performance of the literature of a specific D.M.A. Applied Music field.

Conducting

410. *Conducting.* S. 3 hr. PR: Music 51 or equiv. Instrumental and choral conducting. Major works are prepared and conducted through the use of recordings and music organizations.

Literature

221. *Music Before 1500.* II. 3 hr. PR: Music 33-34 or consent. A study of sacred and secular monophony, Notre Dame organa, thirteenth-century motet and conductus, and fourteenth- and fifteenth-century polyphony in France and Italy.
222. *Music of the Sixteenth and Seventeenth Centuries.* II. 3 hr. PR: Music 33-34 or consent. A study of styles and forms from the High Renaissance to the Late Baroque. (Course will not be offered in 1981-82.)
223. *Music of the Eighteenth Century.* S. 3 hr. PR: Music 33-34 or consent. A study of styles and forms of the Late Baroque through the Classic period.
224. *Music of the Nineteenth Century.* I. 3 hr. PR: Music 33-34 or consent. A study of styles, forms, and theoretical concepts illustrative of nineteenth-century music.
225. *Music of the Twentieth Century.* II. 3 hr. PR: Music 33-34 or consent. A study of stylistic trends during the twentieth century.
230. *Music of Africa.* I. 3 hr. Traditional music of selected areas of Africa south of the Sahara with particular reference to East Africa. The diverse musical cultures with emphasis on historical background, instruments, ensembles, forms, and styles, and music in its social context.
239. *Collegium Musicum.* I, II. 1-2 hr. (May be repeated for credit.) PR: Consent. Study of outstanding musical works not in the standard repertory. Performance of vocal and instrumental music, investigation of performance practices, preparation of editions, and direction of rehearsals under supervision.
335. *Survey of Vocal Music.* I. 3 hr. PR: 6 hr. upper-division music history. Survey of masses, oratorios, cantatas and operas from late Renaissance to the twentieth century. Solo repertoire will not be included. (Course will not be offered in 1981-82.)

336. *Survey of Instrumental Music*. II. 3 hr. PR: 6 hr. upper-division music history. Survey of instrumental ensemble music, chamber music, concertos, symphonies, and other orchestral music from late Renaissance to the twentieth century. Solo repertoire will not be included.
423. *Keyboard Literature*. S. 3 hr. PR: Music 218, 219. Intensive study of the literature for keyboard instruments and the history of the literature.
424. *Song Literature*. S. 1-3 hr. PR: Music 218, 219. Intensive study of the Art Song and the Lied and the history of their development. *(Course will not be offered in 1981-82.)*
428. *Aesthetics of Music*. II. 2 hr. PR: Music 33, 34 or consent. Examination of the main classical and contemporary aesthetic theories and their applications to music.
430. *Introduction to Musical Bibliography*. I. 3 hr. PR: Music 33 and 34 or equiv. Survey of musical bibliography with appropriate research assignments.
438. *History of Notation*. II. 3 hr. PR: Music 33, 34, or equiv. Detailed study in transcribing the musical manuscripts of the Middle Ages. *(Course will not be offered in 1981-82.)*
439. *History of Notation*. II. 3 hr. PR: Music 33, 34, or equiv. Continuation of Music 438 covering the Renaissance period. *(Course will not be offered in 1981-82.)*

Church Music

429. *Survey of Sacred Music*. S. 4 hr. PR: Music 33, 34 or equiv. Study of music suitable to the liturgical year, including the historical background of the Jewish, Catholic and Protestant liturgies.

Music Education

240. *Clinic Chorus, Band, and Orchestra*. I, II. 1 hr. Experience in selection, preparation, and class performance of music appropriate for high school choral and instrumental groups. Students who have completed four semesters of Music 51 will prepare, teach, and conduct class performances. *(Course will not be offered in 1981-82.)*
243. *Music Workshops*. I, II, S. 1-2 hr. *(May be repeated for credit.)*
245. *Marching Band Techniques*. I. 2 hr. PR: One semester college marching band experience or consent. Study and practical application of techniques of planning and preparation of school marching band performances.
248. *Music Arranging for Public School Groups*. I, II. 2 hr. PR: Music 66. Practical experience in techniques of making simple, workable arrangements of music for public school choral and instrumental performance groups.
341. *Music in the Elementary School*. II. 3 hr. PR: Music 30, 41, 42, or equiv. (Not open to music majors.) Development of skills, procedures, techniques, and materials used by general classroom teacher of music in grades K-8.
342. *Teaching of Music Appreciation*. 3 hr. PR: Music 30, 41, 42, or equiv. (Not open to music majors.) Review of information, materials, sources, and techniques involved in teaching appreciation of music in public schools. *(Course will not be offered in 1981-82.)*
343. *Contemporary Techniques in Classroom Music*. I, S. 3 hr. PR: Music 152 or consent. Principles and practice of contemporary techniques in elementary and junior high school classroom music, including those of Orff and Kodaly. *(Course will not be offered in 1981-82.)*
344. *Appalachian Music for the Classroom*. II, S. 3 hr. Lecture, demonstration, and practical experience in performance of Appalachian vocal and instrumental music and

in use of this music in public school classrooms. May involve fields trips and construction of inexpensive instruments.

- 346. *Musicmaking in MiddleSchool/Junior High*. S. 3 hr. PR: Music 151, 152, equiv., or consent. Identification and sequencing of appropriate concepts and skills for general music class students. Selection and use of materials including popular music. Emphasis on student music-making activities. Evaluation procedures included.
- 440. *Choral Techniques*. II. 2 hr. PR: Music 151, 152 or equiv. Advanced techniques and procedures involved in development of choral ensembles. (Course will not be offered in 1981-82.)
- 442. *Instrumental Techniques*. II. 2 hr. PR: Music 151, 152, or equiv. Advanced techniques and procedures involved in individual performance and instruction through lecture-demonstrations by applied music faculty.
- 444. *Music Education*. S. 3 hr. PR: Music 151, 152, or equiv. Survey and critical study of the total music education program.
- 445. *Supervision of Music*. II. 2 hr. PR: Music 151 or 152 or equiv. Concepts, responsibilities, duties and techniques that the supervisor needs to effectively exercise leadership in developing, coordinating, and refining the complete Music Education program in public schools from kindergarten through twelfth grade. (Course will not be offered in 1981-82.)
- 446. *Introduction to Research in Music Education*. I. 3 hr. PR: Music 151, 152 or equiv. Methods and measures necessary for conduct and understanding of research in music education. (Course will not be offered in 1981-82.)
- 448. *Psychology of Music Learning*. II. 3 hr. Application of learning theory to music learning; nature of musical talent; music talent testing.
- 449. *Psychology of Music*. I. 3 hr. Introductory study of musical acoustics and psychology of perception of music.

Opera

- 419. *Opera Theatre*. I, II. 0-4 hr. PR: Music 19 or consent. Continuation of Music 19. Performance of major roles and advanced production techniques. Qualified students will undertake production-direction projects under supervision.

Theory and Composition

- 260. *Upper-Division Composition*. I, II. 2 hr. (May be repeated for credit.) PR: Two semesters Music 160, or consent based on scores submitted. Creative writing with emphasis on practical composition for performance.
- 263. *Counterpoint*. I. 2 hr. PR: Music 68 or consent. Sixteenth century counterpoint.
- 264. *Counterpoint*. II. 2 hr. PR: Music 68 or consent. Eighteenth century counterpoint.
- 265. *Analysis of Musical Form*. II. 3 hr. PR: Music 68 or consent. Detailed study of the structure of music.
- 266. *Major Project in Theory, Composition, or Music History*. I, II. 2 hr. PR: Music 68.
- 267. *Electronic Music*. I. 2 hr. PR: Music 68 and consent. Technology of producing electronic music. Methods of producing electronic compositions, relationship between sound signal and sound perceived, ear training, analysis of examples from electronic music literature, and composition of electronic music. (Course will not be offered in 1981-82.)
- 268. *Electronic Music*. II. 2 hr. PR: Music 267. Continuation of Music 267. (Course will not be offered in 1981-82.)

460. *Composition*. I, II. 3 hr. (May be repeated for credit.) PR: Consent. Primarily for candidates for graduate degrees in theory or composition.
468. *Compositional Techniques in Contemporary Music*. I. 3 hr. Analysis of twentieth-century music with emphasis upon music composed since 1950.
470. *Orchestration*. I, II. 2 hr. (May be repeated for credit; max. credit, 6 hr.) PR: Music 172 or equiv. Major projects of orchestration.
472. *Band Arranging*. II. 2 hr. PR: Music 172 or equiv. Major projects in arranging for the concert band.
475. *Pedagogy of Theory*. S. 3 hr. PR: Music 68 or consent. Consideration of various approaches to the teaching of theory.
483. *Theory Topics*. II. 3 hr. (May be repeated for credit; max. credit, 6 hr.) Various types of analytical and theoretical problems and approaches to their solutions.

Research and Recital

200. *Directed Music Studies*. I, II, S. 1-4 hr. (May be repeated for credit.) PR: Consent. Studies in applied music, music education, music theory, music history, composition; includes directed or independent study in special topics.
392. *Guided Studies in Music*. I, II, S. 1-3 hr. PR: Graduate standing and consent. Intensive individualized reading reported in group discussions. Course may be repeated as many times as necessary, in as many areas as needed; different sections (i.e. areas) may be pursued simultaneously.
398. *Master's Recital*. I, II, S. 1-4 hr. PR: Music 299 (Senior Recital) or consent. Master's Applied students shall be permitted to give a recital only after they pass a qualifying audition before a designated faculty committee in a semester previous to that in which the recital is to be given.
491. *Special Topics*. I, II. 1-3 hr.
492. *Advanced Studies in Music*. I, II. 1-8 hr. PR: Consent, which in some cases may be contingent upon doctoral foreign language examination or a course in statistics. Intensive individualized reading reported in group discussions. Course may be repeated as many times as necessary, in as many areas as needed, and several different sections (i.e., areas) may be pursued simultaneously.
494. *Doctoral Seminar*. I, II. 2 hr. (May be repeated for credit; max. credit, 8 hr.) PR: Consent. Intensive individual investigation and preparation of research papers. Presented by the combined doctoral staff in music.
496. *Lecture Recital*. I, II. 2 hr. PR: Music 430.
497. *Research*. I, II. 1-15 hr. PR: Music 430 or consent.
498. *Doctoral Recital*. I, II, S. 1-4 hr. PR: Music 398 (Master's Recital) or consent. Master's Applied students shall be permitted to give a recital only after they pass a qualifying audition before a committee of at least three specialists in the area, in a semester previous to that in which the recital is to be given. Acceptance of the recital will be at the discretion of the student's doctoral committee.

NURSING

Lorita D. Jenab, *Dean of the School of Nursing*
Luz S. Porter, *Chairperson of the Graduate Program*
1144 Basic Sciences Building

Degree Offered: M.S.N.

Graduate Faculty: Members Ashley, Jenab, and L. S. Porter. Associate Member Hoff.

Master of Science in Nursing

The School of Nursing offers a program of study leading to the Master of Science in Nursing (M.S.N.) degree. The program of study is designed to prepare the professional nurse as a nurse clinician who has the necessary knowledge, attitudes, and competencies for the advanced practice of nursing in primary health care.

The philosophy and conceptual framework of the School of Nursing provide the frame of reference for the curriculum sequence. Through the core nursing and elective courses culminating in a final semester of intense practicum, the student builds the theoretical, scientific, and humanistic base for nursing practice. Emphasis is placed on developing expertise in advanced nursing practice in primary health care which involves an integration of research, leadership, and education concepts with clinical experiences. The program allows flexibility within the basic curricular structure through the individualization of learning experiences, electives, thesis option, and the opportunity to investigate an area of interest in advanced study.

The pattern and duration for the individual student study plan is determined in consultation with a faculty adviser and is based upon the student's background and goals. The program can be completed in four semesters of full-time study.

Admission Procedure

Applicants wishing to apply to the graduate program in Nursing must obtain two application forms from the Office of Admissions and Records, West Virginia University, Morgantown, WV 26506. The application to the Graduate School is to be returned to that office. The application for the graduate program in nursing must be returned to the Chairperson, Graduate Academic Unit, School of Nursing, West Virginia University, Morgantown, WV 26506.

Admission Requirements

The applicant must:

1. Meet the admission requirements of the Graduate School of West Virginia University.
2. Have completed a baccalaureate program in nursing which is accredited by the National League for Nursing (NLN). Applicants with a baccalaureate degree from nursing programs without NLN accreditation or non-nursing programs will be considered on an individual basis.
3. Have completed a course in introductory statistics.
4. Provide the following:
 - a. Statement of philosophy of nursing and professional goals.
 - b. A letter of recommendation from each of the following: head of undergraduate nursing school, employer and a colleague.
 - c. Evidence of a current professional nursing licensure in at least one state.

Preference is given to an applicant with:

1. An undergraduate grade-point average of B (3.0) or better (A = 4.0).
2. At least one year of professional experience.

When all information has been received, the applicant participates in a personal interview with a graduate faculty member for the purpose of validating admission materials, clarifying admission information, projecting a study

progression plan, and initial advising. Applications for admission are reviewed throughout the year. Class sizes are limited, based on available faculty resources and space.

Degree Requirements

- 1. Completion of 42 semester credit hours. Minimum of 30 hours in nursing and 12 hours of electives, 9 of which must be non-nursing.
- 2. Completion of a Master's Paper (3 hours) or a Thesis (3-6 hours).
- 3. Achievement of an overall academic average of at least B in all work attempted in the master's program.
- 4. Removal of all conditions, deficiencies, and incomplete grades.

Credit hours for courses in which the grade is lower than C will not count toward satisfying graduate degree requirements.

Students are expected to register for courses with letter grades (A, B, C) with the exception of electives which the student may opt to take with Satisfactory (S) or Unsatisfactory (U) grades — subject to the approval of the adviser.

Curriculum

Nursing Theory, Practice and Research (30-33 credits)

	Hr.
Nsg. 300 — Advanced Nursing in Primary Health Care I	3
Nsg. 301 — Advanced Nursing in Primary Health Care II	3
Nsg. 302 — Advanced Nursing in Primary Health Care III	3
Nsg. 310 — Advanced Nursing Practice I	3
Nsg. 311 — Advanced Nursing Practice II	3
Nsg. 312 — Advanced Nursing Practice III	3
Nsg. 370 — Theories in Nursing	3
Nsg. 373 — Research Process and Methods in Nursing	3
Nsg. 400 — Advanced Nursing Practice IV	3
Nsg. 497 — Research (Master's Thesis/Paper)	3-6
	<u>30-33</u>

Electives (9-12 credits)

Nsg. 491 — Advanced	3-0
Cognates	<u>12-9</u>
TOTAL	42

A Progression Plan (Full-time Study)

Semester I		Semester II	
	Hr.		Hr.
Nsg. 300	3	Nsg. 301	3
Nsg. 310	3	Nsg. 311	3
Nsg. 370	3	Nsg. 373	3
	—	Elective	3
	9		<u>12</u>

Semester III	Hr.	Semester IV	Hr.
Nsg. 302	3	Nsg. 400	3
Nsg. 312	3	Nsg. 497	3-0
Nsg. 497	3	Elective	3-6
Elective	3		—
	12		9

TOTAL: 42 hours

Nursing (Nsg.)

300. *Nursing in Primary Health Care I. I.* 3 hr. PR or Conc.: Nsg. 370. (Concurrent enrollment or prerequisite to Nsg. 310.) Analysis and synthesis of concepts in nursing and related sciences for the establishment of the conceptual framework for nursing in primary health care.
301. *Nursing in Primary Health Care II. II.* 3 hr. PR: Nsg. 310. (Concurrent enrollment or prerequisite to Nsg. 311.) Analysis and synthesis of concepts in nursing and related sciences basic to specific strategies for the promotion, maintenance, and restoration of health and prevention of illness with the client's environmental framework.
302. *Nursing in Primary Health Care III. I.* 3 hr. PR: Nsg. 311. (Concurrent enrollment or prerequisite to Nsg. 312.) Analysis and synthesis of concepts in nursing and related sciences basic to the understanding of planned change and the impact in society of nursing practice in primary health care.
310. *Advanced Nursing Practice I. I.* 3 hr. PR or Conc.: Nsg. 300. Selected experiences with clients for the continuing development of skills in health assessment and the application of concepts of nursing in primary health care.
311. *Advanced Nursing Practice II. II.* 3 hr. PR or Conc.: Nsg. 301. Application of concepts and skills relative to the promotion, maintenance, and restoration of health and prevention of illness through continuing client relationships in nursing practice in primary health care.
312. *Advanced Nursing Practice III. I.* 3 hr. PR or Conc.: Nsg. 302. Application of concepts and skills relative to planned change strategies with clients in nursing practice in primary health care.
370. *Theories in Nursing. I.* 3 hr. PR: Graduate standing. Comparative analysis of evolving theories in nursing. Emphasis on the development and testing of nursing theories.
373. *Research Process/Methods in Nursing. II, S.* 3 hr. PR: Nsg. 370. An examination of the research process and methods for incorporation into nursing practice.
400. *Advanced Nursing Practice IV. I, II.* 3 hr. PR: Nsg. 312. Interdependent practice with interdisciplinary seminars for the synthesis of knowledge, attitudes, and competencies in primary health care.
491. *Advanced Study. I, II.* 1-3 hr. PR: Graduate standing, consent. Investigation of topics relative to current issues in primary health care.
497. *Research. I, II.* 3-6 hr. PR: Nsg. 373, consent. (Master's paper/Master's thesis.)

ORTHODONTICS

William W. Merow, *Chairperson of the Department*
1077 Basic Sciences Building
Degree Offered: M.S.
Graduate Faculty: Members Merow and Moore.

Master of Science

The School of Dentistry and its Department of Orthodontics offer a program of advanced study and clinical training leading to the degree of Master of Science. The program requires a minimum of 24 months (two academic years and two summers) of full-time residency in the School of Dentistry, and is designed to qualify dentists for careers in orthodontic clinical practice, teaching, and research.

Inquiries concerning this program should be directed to the Office of the Associate Dean for Advanced Education Programs. Applicants will be recommended to the Graduate School for admission. Those applicants approved for admission to the program will be notified soon after January 15.

Requirements for Admission to the Orthodontic Program

1. Graduation from an accredited dental school.
2. Evidence of scholastic and clinical achievement that would indicate the applicant's ability to progress in a program of this nature.
3. Each applicant must file with the department all information requested in the department application form.

Requirements for Master of Science Degree

1. Fulfillment of requirements of the Graduate School.
2. Twenty-four months (two academic years and two summers) of consecutive residency at the School of Dentistry.
3. An approved master's thesis based on original research completed during the period of residency in an area related to orthodontics.
4. Must satisfactorily pass a final oral examination.
5. Must complete a minimum of 50 credit hours. These include 35 hours of orthodontic courses, a minimum of 9 hours of selected basic sciences subjects, a minimum of 6 hours of elective allied subjects, and a thesis (6 hours).
6. Must have demonstrated satisfactory clinical competence in the student's field.
7. Must have maintained a grade level commensurate with graduate education.

Anatomy (Anat.)

315. *Craniofacial Osteology and Myology*. I. 3 hr. PR: Dental, medical, or graduate student standing or consent. Study of craniofacial embryology, morphology and physiology with special emphasis on articulations and their clinical applications.
316. *Craniofacial Growth and Maturation*. II. 3 hr. PR: Anat. 315 or consent. The current concepts of craniofacial growth and maturation are presented and integrated for application to clinical problems.

Orthodontics (Dent.)

- 416. *Biomechanics*. I, II, S. 2 hr. PR: Consent. Design and function of the teeth and their surrounding structures, and response of these tissues to orthodontic procedures.
- 417. *Orthodontic Technique*. I, II, S. 2 hr. PR: Consent. Laboratory course in techniques related to fabrication and manipulation of orthodontic appliances.
- 418. *Orthodontic Materials*. I, II, S. 1 hr. PR: Consent Physical properties of materials used in orthodontic appliances.
- 419. *Orthodontic Diagnosis*. I, II, S. 1-3 hr. PR: Consent. Seminar-type class on technique of patient examination, acquiring diagnostic records, and analyzing and correlating this information to the treatment of clinical problems.
- 420. *Cephalometrics*. I, II, S. 1-3 hr. PR: Consent. Use of radiographic cephalometry in studying growth of the human face, analysis of dentofacial malformations, and evaluation of orthodontic treatment.
- 421. *Orthodontic Mechanics*. I, II, S. 1-4 hr. PR: Dent. 416, 417. Seminar and laboratory course on basic orthodontic mechanical properties.
- 422. *Advanced Orthodontic Mechanics*. I, II, S. 1 hr. PR: Dent. 421. Continuation of Dent. 421 involving more difficult type cases and introducing more sophisticated appliance therapy.
- 423. *Growth and Development*. I, II, S. 1-5 hr. PR: Consent. Seminar-type course on normal and abnormal growth of the human head and its application to orthodontics.
- 425. *Orthodontic Seminar*. I, II, S. 1-8 hr. PR: Consent. Discussions involving all branches of dental science, with special emphasis on the orthodontic interest. Assigned topics and articles in the literature discussed.
- 426. *Orthodontic Clinic*. I, II, S. 1-12 hr. PR: Dent. 416, 417. Clinical treatment of selected patients.
- 497. *Research*. I, II, S. 1-15 hr.

Pathology (Path.)

- 401. *Advanced Oral Pathology*. I, II. 1-3 hr. PR: Consent. Advanced seminar of independent study of local and/or systemic disease processes affecting oral and facial structures.

Statistics (Stat.)

- 311. *Statistical Methods 1*. I, II. 3 hr. PR: Math 3. Statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformations, F and Chi-square distributions, analysis of variance and multiple comparisons. (Equiv. to Ed. P. 311 and Psych. 311.)

PETROLEUM ENGINEERING

James A. Wasson, Chairperson of the Department
109 White Hall

Degrees Offered: M.S.Pet.E., Ph.D.

Graduate Faculty: Member Rieke. Associate Members Al-Saadoon, Laird, Sawyer, and Wasson.

Master of Science in Petroleum Engineering (M.S.Pet.E.)

A student desiring to take courses for graduate credit at the master's level in the College of Mineral and Energy Resources must first apply for admission to the Graduate School and state the major field.

An applicant with a baccalaureate degree, or its equivalent in petroleum or natural gas engineering, will be admitted on the same basis as graduates of WVU. Lacking these qualifications, the applicant must first fulfill the College of Mineral and Energy Resources requirements of the Department of Petroleum Engineering.

Academic Standards. Each student will, with the approval of the student's graduate committee — appointed with the consent of the student within the first semester of registration — follow a planned program. The program contains a minimum of 24 hours of course work and 6 hours of independent and original study in the petroleum engineering field leading to a master's thesis or 30 hours of course work and 3 hours of independent study leading to a comprehensive problem report. At least 60 percent of the course credits must be from 300-level or 400-level courses while the remainder can be made up of 200-level courses.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

No credits are acceptable toward an advanced degree which are reported with a grade lower than C. To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0 based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing independent, original study in petroleum engineering.

Each degree candidate is required to take Pet.E. 496.

Doctor of Philosophy (Ph.D.)

A Ph.D. degree in Petroleum Engineering can also be earned utilizing the multidisciplinary engineering Ph.D. under the control of the Graduate School. A student desiring to take courses for graduate credit in the College of Mineral and Energy Resources must first apply for admission to the Graduate School and state the major field. For information concerning applications and requirements for the interdisciplinary Ph.D. program, see the interdisciplinary Ph.D. program under College of Engineering.

Petroleum Engineering (Pet.E.)

- 207. *Natural Gas Engineering*. I. 4 hr. PR: Pet.E. 211, A.E. 114. Principles of natural gas production, transmission, distribution, processing, regulation, measurement, storage, and analysis with a laboratory devoted to principles of equipment utilized in the operations. 3 hr. lec., 3 hr. lab.
- 210. *Drilling Engineering*. I, II. 3 hr. PR or Conc.: Geol. 1, Math. 18, A.E. 114. Rock properties, well-bore hydraulics, air and gas drilling factors affecting penetration rate, slim-hole, lifting capacity liquid, air, or gas, two-phase flow, casing and casing string design, well-bore primary and squeeze cementing, vertical and directional drilling, minimum cost drilling. 3 hr. lec.

211. *Production Engineering*. I, II. 3 hr. PR: Pet.E. 210. Well completion, performance of productive formation, drill stem tests, completion of wells, flowing wells, gas lift methods and equipment, pumping installation design, well stimulation, emulsion, treating, gathering and storage of oil and gas, field automation. 3 hr. lec.
212. *Drilling Fluids Laboratory*. I. 2 hr. PR or Conc.: Pet.E. 210, Chem. 141, A.E. 114. Drilling fluids control relative to pilot testing, drilling fluid design procedures and measurement of composition and properties. 1 hr. lec., 3 hr. lab.
215. *Transport Phenomena in Petroleum Engineering*. II. 3 hr. PR: Math. 17 and M.E.M. 42. Introduction to fluid flow in pipes, two-phase flow, rotary drilling hydraulics, primary cementing jobs, flow calculations, flow measuring devices, fluid machinery, dimensional analysis, and heat transfer.
216. *Petroleum Engineering Design*. II. 3 hr. PR: Pet.E. 234. Comprehensive problem in design involving systems in oil and gas production, field processing, transportation, and storage. Three 3-hr. labs.
224. *Petroleum Engineering Problems*. I, II, S. 1-6 hr. PR: Engl. 208, senior or graduate standing. Investigation and detailed report on a special problem or subject area in petroleum or natural gas engineering. Supervised by a member of the Petroleum Engineering faculty. A final oral examination is required.
233. *Elements of Petroleum Reservoir Engineering*. I, II. 3 hr. PR: Pet.E. 236. Basic properties of petroleum reservoir rocks. Fluid flow through porous materials. Evaluation of oil and gas reserves. 3 hr. lec.
234. *Applied Petroleum Reservoir Engineering*. I. 3 hr. PR: Pet.E. 233. Application of reservoir engineering data to calculation of recovery potentials and to analysis, simulation, and prediction of reservoir performance under a variety of production methods to effect maximum conservation. 3 hr. lec.
235. *Formation Evaluation*. I, II. 3 hr. PR: Math. 17, Pet.E. 210 or consent. Various well logging methods and related calculations with exercises in interpretation of data from actual well logs. 2 hr. lec., 3 hr. lab.
236. *Mechanics of Hydrocarbon Fluids*. I, II. 3 hr. PR or Conc.: Chem. 141. Qualitative and quantitative phase behavior of single and multicomponent hydrocarbon systems with emphasis on application to petroleum production engineering and petroleum reservoir engineering. 2 hr. lec., 3 hr. lab.
241. *Oil and Gas Property Evaluation*. I. 3 hr. PR: Pet.E. 211, 234, 235. Petroleum property evaluation. Calculation of reserves and future reservoir performance, decline curves, production and formation testing, pressure transient analysis, reservoir test limit, analysis of data, curve fitting, evaluation of processing facilities, and analysis of profitability. 3 hr. lec.
244. *Petroleum Reservoir Engineering Laboratory*. II. 1 hr. PR or Conc.: Pet.E. 233. Laboratory evaluation of basic and special petroleum reservoir rock properties. 3 hr. lab.
262. *Introduction to Reservoir Simulation*. I. 3 hr. PR: I.E. 281, Pet.E. 233, 236. Partial differential equations for fluid flow in porous media and the use of finite-difference equations in solving reservoir flow problems for various boundary conditions. Study of individual well pressures and fundamentals of history matching.
300. *Hydrocarbon Production From Carbonate Rocks*. II. 3 hr. PR: Pet.E. 233, 235. Theory on the production of oil and gas from carbonate rocks, definition and classification of pore geometry, fluid flow characteristics, performance of carbonate rock reservoirs and stimulation of these reservoirs. 3 hr. lec. (Course will not be offered in 1981-82.)
301. *Advanced Petroleum and Natural Gas Engineering Design*. I, II. Credit arranged. PR: Graduate or senior standing. Advanced detail design problems in some phase of

petroleum and natural gas exploration, production, and transportation, particularly incorporating new ideas, machines, and methods.

- 302. *Fluid Flow in Porous Media*. I. 3 hr. PR: Pet.E. 234, Math. 18 or consent. Theoretical and practical aspects of the physical principles of hydrodynamics in porous media. 3 hr. lec.
- 340. *Secondary Recovery of Oil by Water Flooding*. I. 3 hr. PR: Pet.E. 233. Theory of immiscible fluid displacement mechanism, evaluation and economics of water flood projects, and oil field flooding techniques. 3 hr. lec.
- 342. *Well Stimulation by Hydraulic Fracturing*. I. 3 hr. PR: Pet.E. 210, 233. Hydraulic fracturing fluids. Parameters involved in fracturing. Fracture initiation, orientation, and extension. Productivity increase after fracturing. Propping agents and general fracturing treatment design. Optimization of fracturing cost. 3 hr. lec. (Course will not be offered in 1981-82.)
- 343. *Advanced Secondary Recovery*. II. 3 hr. PR: Pet.E. 340. Secondary recovery of oil by gas flooding, miscible fluid injection, in situ combustion, and heat injection. 3 hr. lec.
- 362. *Reservoir Simulation and Modeling*. II. 3 hr. PR: Pet.E. 262 or consent. Application of finite-difference equations to multi-phase fluid flow in porous media in two or three dimensions with gravity and capillary pressure effects. Simulation of water-flood performance and enhanced recovery techniques.
- 394. *Special Topics*. I, II. 1-6 hr. PR: Consent. Selected fields of study in petroleum and natural gas engineering.
- 430. *Geothermal Reservoir Engineering*. II. (Alternate Years.) 3 hr. PR: Pet.E. 235, 233 or concurrent. Application of reservoir engineering concepts to the evaluation of geothermal reservoirs. Analysis and prediction of reservoir performance and calculation of geothermal energy reserves employing a variety of production methods.
- 496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. Individual study and oral presentation of selected topics in petroleum engineering. Current petroleum literature and research are discussed.
- 497. *Research*. I, II. 1-15 hr.

General Minerals Program (M.)

- 250. *Evaluation of Capital and Operating Costs*. I, II. 3 hr. PR: Math. 18 or consent. Estimating capital and operating costs of mineral industries. Evaluation of potential investments, comparisons of investment alternatives, estimation of profitability, and payout of new ventures. Special problems of investment decisions in mining, petroleum, and other facets of the mineral industries. 3 hr. lec.

PHARMACEUTICAL SCIENCES

John W. Mauger, *Chairperson of Graduate Studies*

1121 Basic Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Baldwin, Howard, Lim, Ma, Malanga, Mauger, Miller, O'Connell, O'Donnell, Stratford, and Wojcik. Associate Members Berger, Brister, Covington, Jacknowitz, and Riley.

The School of Pharmacy offers graduate programs in the pharmaceutical sciences aimed at educating competent researchers and teachers. Programs for the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) provide

flexible, research-oriented curricula designed to develop the interests, capabilities, and potential of the individual student.

(Information concerning the School of Pharmacy's bachelor's program is available in the WVU Medical Center Catalog.)

Applicants for admission must satisfy the general requirements for admission to the WVU Graduate School. The applicant must possess a baccalaureate degree with a background in a suitable area of study, an overall grade-point average of at least 2.75, and the aptitude and interest for graduate work in the pharmaceutical sciences. In addition, graduate record examination scores in the verbal, quantitative, and analytical portions of the examinations are required from all students, and TOEFL, or similar scores, are required of foreign students.

Academic Standards

No credits are acceptable toward a graduate degree with a grade lower than a C.

The graduate student must have a cumulative grade-point average of at least 3.0 in all graduate courses to qualify for the degrees.

Master of Science (M.S.)

The School of Pharmacy offers programs of graduate study leading to the degree of Master of Science (M.S.) in the pharmaceutical sciences. Students may specialize in pharmacy administration, pharmacology and toxicology, pharmacognosy, pharmaceutical chemistry, industrial pharmacy, medicinal chemistry, pharmaceuticals, biopharmaceuticals, and pharmacokinetics.

Requirements for M.S. Degree

To be eligible for the M.S. degree, the student must complete a minimum of 30 hours of graduate credit, of which no more than 6 hours may be for research and thesis.

Upon completion of the course work and research requirements, and after submission of the thesis, an oral examination will be administered by the appointed examination committee.

Doctor of Philosophy (Ph.D.)

The School of Pharmacy offers programs of study leading to the Doctor of Philosophy (Ph.D.) degree in the pharmaceutical sciences. Specialty areas of study include medicinal chemistry, pharmaceuticals/biopharmaceuticals/pharmacokinetics, and behavioral and administrative pharmacy.

Requirements for Ph.D. Degree

The student's first semester is usually occupied with course work while he or she is under the guidance of an assigned interim committee. During this time, each student will confer with several faculty members concerning the research project, and a major professor should be chosen by the end of the first semester of graduate study. The student's research committee should be chosen by the end of the first year of study (18-20 hours of graduate course work). The interest to pursue the M.S. en route to the Ph.D. degree should also be stated at this time.

It is not necessary for all students to complete all requirements for the M.S. degree in order to qualify for admission into the Ph.D. program, although the student, with committee advice, may elect to complete the requirements for this degree in progress toward the Ph.D. Students bypassing the M.S. must meet all requirements for the M.S., except for preparing and defending a thesis.

A formal plan of study and research plan must be submitted to the Graduate School by the student, the major professor, and the research committee.

Progress will continue with guidance from the research committee and by the end of the second year the student should have completed the language/research tool requirements.

To be admitted for candidacy for the Ph.D. degree the student must satisfy the above requirements and pass oral and written qualifying examinations.

After admission to candidacy a substantial part of the program is devoted to an original research project which culminates in a dissertation. To be recommended for the Ph.D., the dissertation must be satisfactorily completed and defended at an oral examination.

Pharmaceutical Chemistry (Ph. Ch.)

- 370. *The Synthesis of Drugs.* I or II or S. 3 hr. PR: Chem. 332 and consent. A survey of the approaches employed in the synthesis of a variety of examples of pharmacologically useful agents. Emphasis is placed on retrosynthetic analysis of target molecules and the application of synthetic procedures to multi-step synthesis.
- 375. *Advanced Pharmaceutical Analysis.* 3 hr. Spectroscopic methods of analysis with emphasis on their applications in pharmaceutical problems and in biological sciences.
- 376. *Advanced Pharmaceutical Analysis.* 3 hr. Continuation of Phar. 375, with emphasis on electro-analytical methods and preparation of samples from pharmaceutical dosage forms and from biological materials.
- 377. *Advanced Pharmaceutical Analysis.* 3 hr. Physical-chemical principles involved in methods development. A special problem is assigned as an integral part of the course.

Pharmacognosy (Pcog.)

- 340. *Organic Plant Constituents.* 3 hr. Occurrence, properties, biogenesis, etc. of a number of classes of organic compounds derived from plants. Emphasis on secondary metabolites which contain products of pharmaceutical or medicinal interest. (Course will not be offered in 1981-82.)
- 341. *Isolation of Plant Constituents.* 3-5 hr. Acquaints the student with techniques used in extraction, separation, and isolation of plant constituents. (Course will not be offered in 1981-82.)

Pharmacy (Phar.)

- 300. *Industrial Pharmacy.* 4 hr. PR: Phar. 204 or graduate standing. Introduction of the manufacture of dosage forms of their quality control. Structure of the industry and governmental influences. Special attention to new drug evaluation with regard to safety and efficacy.
- 314. *Cosmetic Formulation.* 3 hr. PR: Phar. 203. Introduction to principles and basic considerations of cosmetic formulations, including review of anatomy/physiology of skin. Laboratory exposes students to practical aspects of processing the more popular cosmetic products.

315. *Physical Pharmacy*. 3 hr. PR: First-year standing in pharmacy. Designed to illustrate the special application of physicochemical properties of materials to pharmaceutical and physiological systems. Especially useful in delineating formulation considerations impinging upon the stability of complex systems.
301. *Advanced Biopharmaceutics*. 3 hr. Concepts of biopharmaceutics and pharmacokinetics in relation to the design and evaluation of dosage forms and determination of rational dosage regimens in health and disease.
302. *Advanced Pharmaceutics*. 3 hr. Physiochemical and biopharmaceutical principles involved in disperse systems (liquid, semi-solid, and solid) which function as dosage forms. Considerations of properties of solid dispersions, micromeritics, diffusion of liquid dispersions, interfacial phenomena, emulsification, suspensions, prolonged action medication, etc.
390. *Special Topics*. 1-4 hr.
391. *Seminar in Pharmaceutical Sciences*. 1 hr. Presentation and discussion of special topics and research in the pharmaceutical sciences.
396. *Special Problems in Pharmaceutical Sciences*. 1-3 hr. Where special interest is shown by the student in an area other than of the student's thesis research, a faculty member will supervise individual study and research.
491. *Advanced Study*. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
496. *Graduate Seminar*. 1 hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and graduate student body of the student's program.
497. *Research*. 1-15 hr.
498. *Thesis*. 2-4 hr. PR: Consent.

Pharmacy Administration (Phar. Ad.)

232. *Social Aspects of Pharmacy*. 3 hr. Psycho-social aspects of pharmacists and patients in health care setting. Behavioral science factors which affect whether, why, or how medications and pharmaceutical services are used; role of pharmacists in health care.
320. *Drug Regulation and Control*. 3 hr. Legislation affecting the development, introduction, control, and utilization of drugs in the American economy.
321. *Drug Distribution Systems*. 3 hr. Detailed study and analysis of drug distribution in institutional environments.
323. *Economics of the Pharmaceutical Industry*. 3 hr. History, background, and formation of major drug industries, Oligopolistic practices, mergers, combines, costs of research, and production.

PHARMACOLOGY AND TOXICOLOGY

William W. Fleming, *Chairperson of the Department*

3151 Basic Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Azzaro, Bell, Colasanti, Craig, Fedan, Fleming, Graves, Head, Mawhinney, Reasor, Robinson, Smith, Stitzel, Thomas, Van Dyke, and Westfall.

Pharmacology and Toxicology involve all aspects of the action of drugs on living systems and their constituent parts. These range from the chemical reactions taking place within cells to the evaluation of a drug in the treatment of human disease. The Department of Pharmacology and Toxicology offers graduate studies leading to the degrees of Master of Science and Doctor of Philosophy with research concentrations in such areas as autonomic pharmacology, biochemical pharmacology, neuropharmacology, psychopharmacology, molecular pharmacology, cardiovascular pharmacology, endocrine pharmacology, pharmacogenetics, malarial chemotherapy, and toxicology.

Admission Requirements

Regular applicants for the graduate program in pharmacology and toxicology should present, as a minimum, the following undergraduate courses: one semester of biology; two semesters of physics; one semester of calculus; five semesters of chemistry including two semesters of organic chemistry and one semester of physical chemistry. Reading knowledge of at least one foreign language is strongly recommended. Three letters of recommendation from science professors, an official transcript, and the results of the Graduate Record Examination — including the advanced test in either chemistry or biology — are also required. The prospective student should have a minimum 3.0 overall grade-point average at the undergraduate level.

In general, students requesting financial support should have all credentials forwarded by February 1. For additional information write to the Director of Graduate Studies, Department of Pharmacology and Toxicology, WVU Medical Center, Morgantown, WV 26506.

Master of Science

Ordinarily the department does not accept graduate students solely into a master's program. However, the master's degree is offered and is recommended as an intermediate degree en route to the Ph.D. Its primary function, as viewed by the faculty, is as an aid to the student new to research for the formulation, conduct, and writing of an abbreviated, but complete, independent research project. The course work requirements for the M.S. in pharmacology and toxicology usually consist of Physiology 344 and 345, Biochemistry 231, Statistics 311, Pharmacology and Toxicology 361, 363, 364, 461, 462, and 497. Some students may, with the faculty's concurrence, choose to proceed directly with their doctoral research without a master's degree. These students must submit a comprehensive progress report on their research to date before taking either the written or the oral Ph.D. qualifying examination.

Doctor of Philosophy

Before official admission to candidacy for the doctorate, the student must satisfactorily complete both a written and an oral comprehensive qualifying ex-

amination. The written examination is generally taken during the sixth semester in the program (not counting summers) on or about March 1. The student will generally have some choice as to questions which must be answered. Two days (6 hours a day) are generally required to complete the written examination. When a student has successfully passed the written examination, a committee — ordinarily consisting of at least three members of the Department of Pharmacology and Toxicology and two members from outside the department — is appointed and constitutes the oral examining body. The oral portion of the qualifying examination is held not less than two or more than six weeks after the successful completion of the written examination.

Dissertation

Upon admission to candidacy for the degree of Doctor of Philosophy, the candidate must select a topic for the dissertation under the direction of the candidate's adviser, complete a dissertation which makes a contribution to knowledge in the candidate's area of concentration, and pass an oral examination based primarily upon the dissertation. After successful completion of the oral examination and submission of the final copy of the dissertation, the candidate will be recommended for the degree.

Research and Instruction

Research Areas — Autonomic pharmacology; autonomic regulation of the cardiovascular system and of smooth muscle; sensitivity to autonomic drugs; electrophysiologic studies of cardiac and smooth muscle; synthesis, storage, release and metabolism of transmitters and adrenal medullary hormones. Chemotherapy: Antimalarial agents, anticancer agents, effects of pharmacological agents on single cell organisms. Biochemical pharmacology: Drug metabolism, effects of drugs on lipid and nucleic acid metabolism. Endocrine pharmacology: Mechanism of action of steroids, metabolism of sex accessory tissues, relationship of hormones to tumor growth and development. Neuropharmacology: Biochemical basis of epilepsy, mechanism of action of anticonvulsant drugs, neuromediators in the central nervous system. Toxicology: Metabolism of toxic agents, pulmonary toxicology, environmental toxicology, perinatal pharmacology and toxicology. Electron microscopy: Effects of drugs on the ultrastructure of cells.

Pharmacology and Toxicology (Pcol.)

160. *Pharmacology*. (For undergraduate students in the paramedical sciences.) II. 3 hr. Interactions of clinically useful therapeutic agents with the mammalian system.
242. *Pharmacodynamics and Therapeutics II*. (For pharmacy and graduate students.) I. 6 hr. PR: Phar. 240 or consent. Continuation of Phar. 240.
360. *Pharmacology*. (For dental and graduate students.) I. 4 hr. PR: Dental student standing or consent. Lecture and demonstrations on pharmacologic actions and therapeutic uses of drugs.
361. *Pharmacology*. (For medical students and a limited number of regular, full-time graduate students in basic medical science departments.) II. 6 hr. PR: Consent of department chairman. Lecture-conference-laboratory on principles, pharmacodynamic actions, and therapeutic applications of clinically useful drugs.

363. *Toxicology*. II. 3 hr. PR: Consent. Theoretical concepts and general principles of toxicology with special emphasis and molecular mechanisms of chemical toxicity.
364. *Advanced Pharmacology*. I. 1-4 hr. PR: Pcol. 361 or consent. Advanced lectures and discussion of general principles of pharmacology and toxicology including physiochemical properties, absorption, distribution and metabolism of drugs, drug receptor theory, and molecular mechanisms of toxicity. (*Offered every third year.*) (*Course will be offered in 1983-84.*)
365. *Advanced Pharmacology*. I. 1-4 hr. PR: Pcol. 361 or consent. Advanced lectures and discussion of specialized areas of pharmacology and toxicology, including biochemical, endocrine, pulmonary, and cardiovascular pharmacology. (*Offered every third year.*) (*Course will not be offered in 1981-82.*)
366. *Advanced Pharmacology (Laboratory in Drug Evaluation)*. S. 1-3 hr. PR: Consent. Laboratory procedures and demonstration in assessing drug action.
367. *Advanced Neuropsychopharmacology*. I. 1-4 hr. PR: Pcol. 361 or consent. Advanced lectures on the actions of drugs on the central and peripheral nervous system. (*Offered every third year.*) (*Course will not be offered in 1981-82.*)
461. *Seminar in Pharmacology*. I, II. 1 hr. per sem. PR: Pcol. 361 or graduate status in basic medical sciences.
462. *Literature Survey*. I, II. 1 hr. per sem. PR: Graduate status in pharmacology and toxicology. Current literature pertinent to pharmacology including journals of allied biological sciences.
490. *Teaching Practicum*. I, II. 1-2 hr. per sem. PR: Pcol. 361 and consent. Critical evaluation of preparation and delivery of lectures in specified areas of pharmacology and toxicology. For advanced graduate students.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Research*. I, II, S. 1-15 hr. per sem.

PHYSICAL EDUCATION

J. William Douglas, *Dean, School of Physical Education*

258 Coliseum

Carl P. Bahneman, *Chairperson, Department of Professional Physical Education*

256 Coliseum

William L. Alsop, *Chairperson, Department of Sport and Exercise Studies*

263 Coliseum

Degrees Offered: M.S., Ed.D. (See Part 3 for doctoral information.)

Graduate Faculty: Members Alsop, Bahneman, Douglas, Fehl, Kurucz, Wiegand, and Ziatz.

Associate Members Blakemore, Brooks, Carson, Devaney, Gilson, Ramsburg, Spiker, Wiedebusch, Wilmoth, and Yeater.

Graduate students in the School of Physical Education pursue courses and scholarly tasks which may lead to the following degrees: (1) Master of Science in Professional Physical Education or Sport and Exercise Studies; and (2) Doctor of Education with concentration in Professional Physical Education or Sport and Exercise Studies.

Master of Science

Professional Physical Education or Sport and Exercise Studies

The School of Physical Education offers courses leading to the Master of Science degree with an emphasis in Professional Physical Education or Sport and Exercise Studies.

Students are admitted as regular graduate students for work leading to the master of science degree in these programs provided they hold a baccalaureate degree from an approved institution of higher education; have a 2.75 undergraduate grade-point average; and satisfy prerequisites in the courses for which they register. When making application to the graduate school, students must indicate program of study (Professional Physical Education or Sport and Exercise Studies).

Students who do not meet the 2.75 grade-point average requirement, but exceed a grade-point average of 2.5, may be admitted as a Regular Graduate Student with deficiencies and will be required to earn a 3.0 average in the first 9 hours of core requirements in order to continue in the major interest area. (Courses taken in off-campus education are accepted for degree purposes provided the student has had prior approval from the student's adviser.) In order to receive the degree the student must have a minimum 3.0 average in all course work leading toward the degree and satisfy all Graduate School requirements.

Master of Science Degree Programs

Professional Physical Education Emphasis Areas

The Department of Professional Physical Education offers the Master of Science (M.S.) degree in the following areas of specialization. Specific course requirements are available upon request.

Early Childhood Physical Education — This specialization is designed to develop a master teacher for the early childhood public school population. Mainstreaming and individualized instructional skills are emphasized.

Adolescent Physical Education — This specialization is designed to develop a master teacher for the adolescent public school population. Mainstreaming and individualized instructional skills are emphasized.

Sport Medicine — This specialization is designed to develop the skills necessary to be an athletic trainer. West Virginia State Certification in Athletic Training is awarded when this specialization is completed. For those students who cannot attend classes during the regular school year, this specialization can be completed in three consecutive summers.

Motor Learning/Development — This specialization provides intensive study of motor learning and development with a research emphasis. A thesis is required.

General Program in Physical Education — This program is designed to provide a broad understanding of the various sub-disciplines within physical education and is of particular value to those students unable to choose a specialization at this point in their graduate study.

Special Physical Education — This specialization is designed to develop a master teacher with the conceptual and methodological skills necessary to teach exceptional children in the public schools.

Sport and Exercise Studies Emphasis Areas

The Department of Sport and Exercise Studies offers the Master of Science degree (M.S.) in the following areas of specialization. Specific course requirements are available upon request.

A. Sport Studies — (1.) Sport Behavior: This specialization concentrates on the psycho/social dimensions of sport. The program emphasizes behavioral, motivational and cultural aspects of man's participation in sport. Students specialize in Sport Psychology or Sport Sociology. Thesis required. (2.) Sport Management: Program emphasis concentrates on management and administration of sport related agencies and enterprises. (3.) Sport Communication: This specialization is designed to provide students with skills to function effectively in sport broadcasting and reporting.

B. Exercise Studies — (1.) Sport Physiology. (2.) Sport Biomechanics: Program emphasis concentrates on the physiological/biomechanical aspects of exercise and sport performance. Thesis required. (3.) Fitness Assessment, Evaluation, and Prescription: Program emphasis concentrates on assessment and evaluation of fitness parameters of all age groups involved in physical activity.

Doctor of Education Program

Professional Physical Education, Sport and Exercise Studies, or Safety Studies

Programs leading to the Doctor of Education (Ed.D.) degree in Professional Physical Education include: Motor Development (Early Childhood, Middle Childhood, Adolescence, Special Populations) and Administration of Physical Education. Programs leading to the Doctor of Education degree in Sport and Exercise include: Sport Behavior (Sport Psychology/Sociology), Exercise Studies (Physiology/Biomechanics), and Sport Management/Administration. Programs leading to the Doctor of Education degree in Safety Studies include Safety Management, Loss Countermeasures, and Emergency Preparedness.

Admission to the Program

Special-Provisional Status — Individuals who wish to pursue a program leading to the Doctor of Education degree in the School of Physical Education must be admitted to the WVU Graduate School. Applicants for admission must submit: (1) scores on the Aptitude Test of the Graduate Record Examination and/or Millers Analogy Test; (2) three letters of recommendation (one of which must be submitted by the applicant's immediate employment supervisor or master's degree academic adviser); and (3) a complete transcript of undergraduate and graduate education. All materials and procedures must be completed by April 1 of the year in which the applicant intends to initially engage in a doctoral program. Upon completion of the above procedures the student will be admitted as an advanced graduate student with special-provisional status. Within the semester the advanced graduate student with special-provisional status is completing the twelfth hour of resident course work, the student shall request, through the office of the chairperson of the appropriate doctoral program, admission to the program with regular graduate status. Advanced graduate students with special-provisional status cannot register for course work beyond the twelfth hour without having been admitted to the program as a student with regular graduate status.

Regular Graduate Student Status — Acceptance as an advanced graduate student with regular status is contingent upon the graduate committee's decision regarding the applicant's potential for scholarly productivity as judged by Graduate Record Examination and/or Miller Analogy scores, past performance in course work, letters of recommendation, as well as a personal interview, if deemed necessary. Applicants who satisfy standards for admission will be assigned an adviser based upon the student's program interest.

Program Requirements — Once the student is admitted to the program, the student — in concert with the adviser — will select a doctoral committee. It will be this committee's responsibility to aid the student in planning the total program. During the process of completing a program, the student is expected to fulfill a residency requirement specified by the committee.

Admission to Candidacy Requirements — As the student nears the termination of the course work, application may be made to complete the final comprehensive examination. This examination shall consist of scholarly tasks designed to function as a comprehensive learning experience. The examination will be constructed by the student's doctoral committee. Students who do not successfully complete this examination may be permitted to attempt the examination one more time pending an appeal and subsequent sanction of the student's doctoral committee. There must be a time period of at least six months between the first and second examination periods.

Upon successful completion of the final comprehensive examination, the student may present to the doctoral committee a prospectus of the dissertation. If the opinion of the committee is such that the student may proceed with the dissertation, the student is admitted to candidacy.

Final Requirements — Upon the completion of the dissertation, the candidate will appear before the doctoral committee for purposes of orally defending the study. Successful defense of the dissertation results in the awarding of the degree. All requirements must be completed within seven years.

Physical Education (P.E.)

- 219. *Gross Anatomy. II.* 3 hr. PR: Consent. An overview of body systems and gross anatomy of the trunk and extremities.
- 221. *Advanced Athletic Training. I.* 3 hr. PR: P.E. 121, 164, 165; and Saf. S. 70 or consent. In-depth analysis of preventive measures and treatment procedures and practical experience using therapeutic modalities. Laboratory work included.
- 222. *Advanced Athletic Training. II.* 3 hr. PR: P.E. 221 or consent. Designed to analyze management procedures related to athletic training and provide practical experience in diagnosing and treating athletic injuries. Laboratory work included.
- 223. *Athletic Training Practicum. II.* 3 hr. PR: Junior standing. A practical application of athletic training techniques. Laboratory work included.
- 225. *Program Planning of Recreational Sport. I, II, S.* 3 hr. PR: Graduate standing or consent. An in-depth study of recreational sport programs, including philosophy, objectives, program development, management concepts, and evaluation.
- 300. *Workshop in Physical Education. I, II, S.* 1-15 hr.
- 305. *Philosophical Concepts in Physical Education. I, S.* 3 hr. PR: Graduate standing or consent. Study of educational philosophies and application of these philosophies to physical education; study of the place of physical education in education and modern living.

315. *Research Methodology in Physical Education*. I, S. 3 hr. PR: Graduate standing or consent. Application of historical, descriptive, and experimental research strategies and designs to physical education.
320. *Individual Interaction in Sport and Physical Activity*. I, S. 3 hr. PR: P.E. 315. Designed to acquaint the student with the reciprocal relationships between sport and physical activity and the societies and cultures out of which sport emerges.
340. *Psychology of Sport and Physical Activity*. I, S. 3 hr. PR: P.E. 315. Psychological effects and implications of man's participation in sport and physical activity. Emphasis is on the personality and behavioral and motivational dynamics of sport involvement.
345. *Group Influences in Sports*. I. 3 hr. PR: Research, Statistics, P.E. 320, 340. The manner and degree to which individuals are affected by involvement in sport and group interactions.
360. *Biomechanical Analysis of Sport and Physical Activity*. II, S. 3 hr. PR: P.E. 164 and 165 or equiv.; P.E. 315. Advanced principles of body mechanics and analysis of muscle and joint actions in coordinated movement and neuromuscular physiology.
365. *Psychomotor Behavior Analysis*. II, S. 3 hr. PR: P.E. 315. In-depth study of psychomotor learning with emphasis on behavioral change in physical activity. Review of research and psychological thought pertinent to motor learning, performance, and physical activity.
366. *Motor Development*. II. 3 hr. PR: P.E. 365 or consent. Developmental examination of motor skill acquisition across the entire life span. Hereditary and environmental factors unique to the motor skill development of the maturing individual will be emphasized.
367. *Theories of Sport Physiology*. I, S. 3 hr. PR: P.E. 315. Thorough and workable knowledge of principles involved in the interactions of muscles and nerves, reflexes, metabolism, cardiopulmonary function, environmental physiology, and the practical application of work physiology.
380. *History of Sport and Physical Activity*. II, S. 3 hr. PR: Graduate standing or consent. Anthropological and historical approach toward the influence of events, political and social climates, and personalities upon the sport cultures from early civilizations to present.
425. *Educational Sport*. II. 3 hr. PR: Stat. 311, P.E. 465. The group dynamics of the sport situation for purposes of gaining insight into techniques and methods of modifying social behavior through physical education sport activities.
445. *Program Planning*. II, S. 3 hr. PR: Graduate standing or consent. An in-depth study of the manner in which the physical education environment is structured to elicit cognitive and psychomotor learnings. Emphasis on program design, behavior modification, and evaluation processes.
446. *Advanced Measurement in Physical Education*. II, S. 3 hr. PR: P.E. 315. Extension and application of basic concepts of measurement and statistical evaluation to physical education.
460. *Management Processes in Physical Education*. II. 3 hr. PR: Graduate standing or consent. Analytical exploration of the situational, relational processes between the administrator of physical education school programs and the teacher of physical education, the physical education facility, and the physical education planned learning environment.
465. *Professional Physical Education Resource Seminar*. S. 3 hr. PR: Graduate standing. Introductory seminar for doctoral professional physical educators. Discussion,

debate, and position statements on critical issues facing the physical education profession. (Required for all doctoral students.)

- 480. *Dissertation/Thesis Seminar*. I, II, S. 3 hr. PR: Graduate standing. Critical analysis of the graduate student's dissertation or research proposal. (Required for all doctoral students.)
- 490. *Teaching Practicum*. I, II, S. 3-15 hr.
- 491. *Advanced Study*. I, II, S. 1-6 hr.
- 492-495. *Special Seminars*. I, II, S. 1-6 hr. ea.
- 496. *Graduate Seminar*. I, II, S. 1-6 hr.
- 497. *Research*. I, II, S. 1-15 hr.
- 498. *Thesis*. I, II, S. 1-15 hr.
- 499. *Colloquium*. I, II, S. 1-6 hr.

Dance (Dance)

- 301. *Rhythms and Dance*. I, S. 3 hr. PR: Graduate standing and consent. Principles of movement, materials, and practicum in dance.
- 302. *Modern Dance Techniques and Composition*. II, S. 3 hr. PR: Dance 35 and 37 or equiv., graduate standing or consent. Scientific principles of movement; basic principles of music as related to dance movement; choreographic principles; practicum in dance movement. Principles for teaching dance and problems involved in planning program.
- 303. *American Folk Dance*. I, S. 3 hr. PR: Dance 39 or equiv. American square, contra, circle, and round dance, and their relationships in the arts and aspects of American culture. Analysis of techniques in leading and calling.
- 304. *History and Philosophy of Dance*. II, S. 3 hr. PR: Dance 302 or equiv. Cultural survey of dance as an expression of the society it represents; philosophy of dance; relation of dance to other art forms; dance as an educational experience.

PHYSICS

William E. Vehse, Chairperson of the Department
244 Hodges Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Arya, Cooper, Ferer, Jefimenko, Levine, Littleton, McDonnell, Montano, Pavlovic, Rotter, Seehra, and Vehse. Associate Member Goldberg.

The Department of Physics offers opportunities for graduate study and research leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) with research specialties in the following areas: experimental solid state physics (magnetic, electrical, ultrasonic, surface, thermal and optical properties); theoretical solid state physics (rare earth and actinide magnetism, surface and interface phenomena, metal physics); the study of critical phenomena; nuclear spectroscopy; Mossbauer studies; theoretical and experimental research in electrostatics; classical and quantized field theories; theoretical studies in gas dynamics and combustion theory; theoretical and experimental investigations on the separation of impurities for coal; astrophysics; and macromolecular physics.

In addition to the M.S. and Ph.D. programs, the department offers a series of courses during the summer designed specifically for teachers who wish to improve their skills in physics or astronomy.

Applicants for graduate study in physics should have the equivalent of a bachelor's degree. Before the start of the first semester in which the students are enrolled, they are interviewed by members of the faculty concerning their physics backgrounds in order that they may be counseled concerning their initial plan of study.

The general Graduate School requirements for the master of science degrees are given in Part 3 of the *Graduate School Catalog*. Of the 30 hours of course work specified by the Graduate School, 6 may be earned in thesis research, another 12 are required as basic courses by the department, and the remaining 12 are chosen by the student and faculty adviser to fit the individual needs of the student. The student is often encouraged to diversify studies by taking courses in related departments. Each student is required to complete a research project and write a thesis based on this project. In addition to the research areas listed above, the thesis may be on a project on the history or teaching of physics. The student must pass a written examination based on course work and an oral examination based on the thesis.

To be admitted to candidacy for the Ph.D. degree, students must pass written examinations in mechanics, electricity and magnetism, and quantum mechanics. Following completion of additional course work at the advanced level, the candidates must pass a qualifying examination emphasizing mastery of their research areas. To receive the Ph.D., the student must complete a research project and successfully defend a dissertation based on this project and submit for publication a paper based on the dissertation research. Each candidate must satisfy the departmental language requirements in one language (French, German, or Russian), or show proficiency in computer programming.

In addition to the research facilities on campus, students may have access to the facilities at Oak Ridge National Laboratory through Oak Ridge Associated Universities Research Participation Grants. Under suitable conditions, students may obtain part-time employment on the research staff of the Morgantown Energy Technology Center (U.S. Department of Energy), or the National Institute of Occupational Safety and Health. Research done at these off-campus facilities, if approved by the department, is applicable to the M.S. and Ph.D. degrees.

The course offered by the department for graduate study apart from those for education majors are essentially of three types. Phys. 331, 333, 351-52, 383, and 387 serve as a nucleus of basic courses required of most students. A second group consists of standard electives offered in alternate years. The third type consists of courses, listed as special topics or advanced research topics, which are either programs of independent study designed to suit the needs of the individual student or courses based on some topic of current and lively interest.

Physics (Phys.)

- 201. *Special Topics*. I, II. 1-3 hr. (May be repeated to a maximum of 24 hours.) Study of topics of current interest in physics.
- 213. *Electronics*. I, II. 3 hr. PR: Phys. 12. Theory, experiments and application of electronics; with laboratory. (Course will not be offered in 1981-82.)
- 225. *Atomic Physics*. I, II. 3 hr. PR: Phys. 124 or equiv. Relativistic mechanics, atomic structure, and spectra.

- 231, 232. *Theoretical Mechanics*. I, II. 3 hr. PR: Phys. 11, 12 or equiv. Scalar, vector, and tensor fields; curvilinear coordinate systems. Kinematics and dynamics of particles, systems, of particles and rigid bodies. Lagrangian and Hamiltonian formulation. Relativistic motion.
- 233, 234. *Electricity, Magnetism, and Radiation Optics*. I, II. 3 hr. per sem. PR: Phys. 11, 12 or equiv. Electrostatics, magnetostatics, introduction to electrodynamics, and applications to optics.
241. *Advanced Physics Laboratory*. I, II. 1-2 hr. Experiments in physics designed to implement theory courses, give experience in data taking and instrumentation, and learn methods of data evaluation and error analysis.
- 247, 248. *Physics Seminar*. I, II. No credit. Suggested for junior, senior, and graduate physics majors. These lectures acquaint students with topics of current interest in physics.
251. *Introduction Quantum Mechanics*. I. 3 hr. PR: Phys. 124. Fundamental principles of quantum mechanics; state functions in position and momentum space, operators, Schrodinger's equation, applications to one-dimensional problems, approximation methods, the hydrogen atom, angular momentum and spin.
263. *Nuclear Physics*. I, II. 3 hr. PR: Phys. 11, 12 or equiv.; Phys. 124. Study of characteristic properties of nuclei and their structure as inferred from nuclear decays and reactions, leading to a knowledge of nuclear forces and models.
271. *Solid State Physics*. II. 3 hr. PR: Phys. 124 or equiv. Properties of crystalline solids; includes crystal structure, binding, lattice vibrations and an investigation of thermal, electrical, magnetic, and optical phenomena based on energy band theory.
283. *Thermodynamics*. II. 3 hr. PR: Phys. 11, 12 or equiv. Introduction to the statistical foundations of thermodynamics. Application of the fundamental laws of thermodynamics to physical and chemical systems.
284. *Kinetic Theory*. II. 3 hr. PR: Calculus, Phys. 11, 12 or equiv. The concepts of probability which lead to the derivation of the Boltzman, Fermi-Dirac, and Bose-Einstein statistics. Application of these statistics to physical and chemical systems. (Course will not be offered in 1981-82.)
301. *Special Topics*. I, II. 1-6 hr. (May be repeated to a maximum of 24 hours.) PR: Consent. Primarily for Graduate students. Specialized topics of current interest in physics.
313. *Introductory Electronics*. S. 3 hr. PR: 1 year college physics. Primarily for Education majors, principles and applications of electrical components and circuits, including solid-state electronics.
321. *Optics*. I, II. 3 hr. PR: Phys. 11, 12 or equiv. A basic course in physical optics covering radiation theory, diffraction, interference, polychromatic waves, scattering, polarization, double refraction, and selected topics in quantum optics.
325. *Advanced Atomic and Molecular Physics*. I. (Alternate Years.) 3 hr. PR: Phys. 351. Advanced quantum theory of atoms and molecules. Detailed treatment of group theoretical background necessary for treating symmetry considerations in quantum mechanics.
331. *Advanced Classical Mechanics*. I. 3 hr. PR: Phys. 231, 232, and differential equations. Lagrange and Hamilton form of equations of motion, rigid bodies, small and nonlinear oscillations. Transformation theory relativistic dynamics, and systems with an infinite number of degrees of freedom.
333. *Advanced Electricity and Magnetism*. II. 3 hr. PR: Phys. 233, 234, and differential equations. Electrostatic and magnetostatic boundary value problems. Maxwell's equations for time varying fields. Green's functions and integral representations;

applications to radiation; diffraction, wave guides, plasma physics, and relativistic motion of charged particles.

- 351, 352. *Quantum Mechanics*. I, II. 3 hr. per sem. PR: Phys. 225, 251. Covers a wide range of topics of current interest at a level such that a student should be able to read basic research papers in many fields upon completion. Topics covered include: approximation methods, representation theory, angular momentum, relativistic quantum mechanics, time dependent perturbation theory, identical particles, scattering, molecules, solids, magnetism, and second quantization of bosons and fermions.
354. *Introduction to Modern Physics*. S. 3 hr. PR: 1 year of introductory college physics. Primarily for Education majors; not open to Physics majors. Elementary study of atomic and molecular structure and spectra, solid state and nuclear physics, relativity and elementary particles.
- 355, 356. *Workshop for Physics Teachers*. SI, SII. 3 hr. per sem. PR: 1 year of college physics, 1 year of college mathematics. Primarily for education majors; not open to physics majors. Techniques of apparatus construction and demonstration.
357. *Photography*. SI. 3 hr. PR: 1 year of college physics or equiv. The physics and chemistry of photography with practical experience. Primarily for education majors; not open to physics majors.
358. *Light*. SII. 3 hr. PR: 1 year of college physics or equiv. A demonstration course designed to illustrate the basic concepts covering light and optics. Primarily for education majors; not open to physics majors.
383. *Statistical Mechanics*. II. 3 hr. PR: Phys. 283, 351, 352. Classical statistics; Boltzman, Fermi-Dirac and Bose-Einstein statistics, theory of fluctuations and applications to physical systems.
387. *Mathematics for Physicists and Engineers*. I. 3 hr. PR: Calculus, differential equations, Phys. 11, 12 or equiv. Complex variables: series, contour integration and conformal mapping; ordinary differential equations; Fourier series, Laplace transforms; Fourier transforms, special functions; Bessel functions and Legendre, Hermite, and Laguerre polynomials; introduction to partial differential equations; Poisson's equation, Wave equation, and diffusion equation.
388. *Mathematics for Physicists and Engineers*. II. 3 hr. PR: Phys. 387 or equiv. Infinite dimensional linear vector spaces; series and Green's function methods of solution of partial differential equations; variational methods. Applications in electricity and magnetism, fluid mechanics, diffusion heat flow, propagation, and scattering phenomena.
401. *Advanced Research Topics*. I, II. 1-6 hr. (May be repeated to a maximum of 24 hours.) PR: Consent. Specialized topics in field of physics related to the research interests of the department. Open only to students who have completed most of the basic graduate courses.
410. *High Energy Physics*. I. 3 hr. PR: Phys. 351, 352. Fundamental particle interactions, field theory, s-matrix expansions, space time symmetries, internal symmetries, unsolved problems.
- 463, 464. *Advanced Nuclear Physics*. I, II. 3 hr. per sem. PR: Phys. 225, 251, and 263. Detailed presentation of nuclear models, nuclear reaction mechanism, nuclear forces and theories of nuclear disintegrations.
471. *Advanced Solid State Physics*. II. (Alternate Years.) 3 hr. Phys. 271, 325, 351. Advanced treatment of solid state theory; electronic, vibrational, transport, thermodynamic and magnetic properties of solids.
497. *Research*. I, II. 1-15 hr.

Astronomy (Astro.)

216. *Astronomy for Teachers*. S. 3 hr. PR: Consent. Basic concepts and methods in astronomy and how to teach them using the celestial sphere and geometrical tools. Observational work at night. The use of a telescope and camera.
255. *Intermediate Astronomy*. II. 3 hr. PR: Math. 16 or consent. Measurement of the universe; trigonometric parallax, statistical parallax, moving clusters, cluster H-R diagrams, masses of various binary systems, Kepler's laws, and the three-body problem.
267. *Basic Astrophysics*. I, II. 3 hr. PR: Phys. 124 or equiv. The several equations of state, the Boltzmann-Saha equation, the H-R diagrams and interpretation of spectra, introduction to radiative transfer and stellar structure.
268. *Galactic Dynamics*. I, II. 3 hr. PR: Astro. 255. The kinematics and dynamics of the galaxy. Methods for determining the rotation parameters of the Milky Way galaxy from radial velocities and proper motions.

PHYSIOLOGY

George A. Hedge, Chairperson of the Department

3051 Basic Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Brown, Castranova, Colby, Franz, Frazer, Gladfelter, Gutmann, Hedge, Johnson, Lee, Miles, Millecchia, Moran, Stauber, and Weber. Associate Members Irish, Klabunde, and Sherwood.

The objective of the Department of Physiology graduate program is to educate physiologists in the methods of conducting independent research of high quality and of effective teaching. The department's graduates are conversant with all aspects of physiology and are prepared to interact creatively with scientists in related fields. To this end the program leading to the degree of Doctor of Philosophy (Ph.D.) emphasizes close interaction of faculty with students and a high faculty/student ratio. The Master of Science (M.S.) program includes 24 hours of course work and a research project leading to the thesis.

Admission Requirements

Individuals from a wide variety of backgrounds study physiology as one of the basic medical sciences. It is, in fact, not uncommon to find physiologists with such diverse backgrounds as biology, chemistry, physics, psychology, engineering, and mathematics. The department encourages the participation of qualified individuals from many undergraduate and graduate disciplines. There are, however, certain prerequisite courses a student must take either before enrollment or during the first year of the program. These prerequisites, designed to give a student the proper foundation for advanced study in physiology, are: Biology (2 semesters), Physics (2 semesters, calculus based desirable), Calculus (2 semesters, 3 desirable), and Organic Chemistry (1 semester). Physical Chemistry is not required, but is desirable.

The department requires the following materials for consideration for the M.S. or Ph.D. program: Three letters of recommendation, transcripts of all undergraduate and graduate grades, a completed departmental application form, and Graduate Record Examination scores (aptitude and one advanced test). A bachelor's degree, or equivalent, is required for admission; an M.S. degree is not a prerequisite for the Ph.D. program.

A complete application kit and detailed descriptions of the degree programs can be obtained by writing to the Graduate Adviser, Department of Physiology, School of Medicine, West Virginia University, Morgantown, WV 26506. Although applications may be submitted as late as June of the year of matriculation, applications must be received before February 1 to be considered for financial aid.

Master of Science (M.S.)

Prerequisites for admission to the master's program are the same as those for the doctoral program. The first academic year and first summer are likewise identical for the master's and doctoral students. During the second year of the master's program, the student enrolls for 6 hours of Advanced Physiology, Graduate Colloquium, and sufficient electives to fulfill the required 24 hours of course work. In addition, 6 hours of research are directed toward completion of the thesis. The M.S. program is usually completed in two years.

Doctor of Philosophy (Ph.D.)

The first year in the program normally includes the following courses: Medical Physiology (10 hours), Biochemistry (7 hours), Statistics (3 hours), Neurophysiology (3 hours) or Neurobiology (6 hours), Graduate Colloquium (2 hours), Physiological Methods (variable credit), electives, and prerequisites (a limited number of which may be made up during the first year). The first-year curriculum familiarizes the student with some of the same basic science material presented to the medical students. Medical physiology, biochemistry, and neurophysiology/neurobiology are part of the medical curriculum. The courses are team-taught by scientists specializing in each of the areas covered. In addition, the student is introduced to the full range of activities in the department through the Graduate Colloquium. Physiological Methods provides a foundation in the research strategies, techniques, and tools used by physiologists.

During the first summer, students may begin research projects in departmental research laboratories of their choice. They also may take elective courses or make up prerequisites.

During the second year, the student combines course work with the continuing development of research interests. A graduate adviser is selected during this year. Courses normally include: Advanced Physiology (12 hours), Graduate Colloquium (2 hours), Seminar (2 hours), and Teaching Practicum (assisting in laboratory/demonstrations, conducting small-group conference sessions, giving lectures). Commonly chosen electives include pharmacology and toxicology, and advanced or specialized topics in biochemistry and biophysics. The second-year curriculum takes the student beyond the medical curriculum, emphasizing critical appraisal of the current research literature. Students begin to present discussions of research topics in the Graduate Colloquium and Seminar.

After completion of the second academic year, the student takes a qualifying examination consisting of a written comprehensive part and both a written and oral research design part. Upon successful completion of the qualifying examination, the student is admitted to candidacy for the degree of Doctor of Philosophy in Physiology.

During the third and fourth years the student may enroll in elective courses. Yearly participation in the Teaching Practicum provides experience in delivering lectures to undergraduate and professional students. However, the

student's major effort is directed toward dissertation research, with presentations about the research in the Graduate Colloquium. During these years the students will attend and present papers at national meetings of scientific societies (American Physiological Society, Biophysical Society, Endocrine Society, Federation of American Societies for Experimental Biology, Society for Neurosciences.) The Ph.D. program is generally completed in four years.

Research and Instruction

Research Areas — Faculty laboratories offer opportunities for research in cardiovascular, cell, endocrine, muscle, neural, renal, and respiratory physiology.

Physiology (Physi.)

141. *Elementary Physiology*. (For undergraduate students in paramedical sciences.) II. 4 hr. PR: College biology and chemistry, or consent. Systematic presentation of basic concepts. 3 lec., 1 lab.
241. *Mechanisms of Body Function*. I. 4 hr. PR: College chemistry, biology, physics, and algebra or graduate status and approval. A systematic examination of the homeostatic functions of the human body with emphasis on the physicochemical mechanisms involved. Pathophysiology and clinical correlations are introduced in relation to normal physiology.
248. *Experimental Design*. (For advanced undergraduate and selected graduate students.) II. 3 hr. PR: Consent. Theory and practical experience in design of experiments and processing of physiological data using small laboratory digital computers. 1 lec., 2 lab.
341. *Physiological Methods I*. II. 1-5 hr. PR: Consent. Research techniques and strategies for physiology. (Designed to be taken in conjunction with Physi. 345.)
342. *Physiological Methods II*. I. 1-4 hr. PR: Consent. Research techniques and strategies for physiology. (Designed to be taken in conjunction with Physi. 344.)
343. *Fundamentals of Physiology*. (For dental students and a limited number of regular full-time graduate students in medical center basic sciences departments.) I. 5 hr. PR: College physics, algebra, chemistry, and consent of department chairperson. Analysis of basic facts and concepts relating to cellular processes, organ systems and their control. 3 lec., 1 conf., 1 lab.
344. *Medical Physiology*. (For medical and a limited number of regular full-time graduate students in medical center basic sciences departments.) I. 5 hr. PR: College physics, algebra, chemistry, and consent of department chairperson. Analysis of basic facts and concepts relating to cellular processes, organ systems, and their control, with clinical correlations. 5 lec., 1 conf.-lab.
345. *Medical Physiology II*. (For medical and a limited number of regular full-time graduate students in medical center basic sciences departments.) II. 5 hr. PR: Physi. 344 and consent of department chairperson. Continuation of Physi. 344. 5 lec., 1 conf.-lab.
346. *Neurophysiology*. (For medical and a limited number of regular full-time graduate students in medical center basic sciences departments.) II. 3 hr. PR: College algebra, physics, and consent of department chairperson. Properties of excitable tissues (nerve and muscle), synaptic transmission, reflexes and central nervous system function, and behavior. 2 lec., 1 conf.
350. *Graduate Physiology 1*. (For graduate students in medical center basic sciences departments and a limited number of other regular full-time graduate students.) I. 6

hr. PR: Calculus, college physics, organic chemistry, biology, and consent of department chairperson. Analysis of basic facts and concepts relating to cellular processes, organic systems, and their control.

351. *Graduate Physiology 2.* (For graduate students in the medical center basic sciences departments and a limited number of other regular full-time graduate students.) II. 6 hr. PR: Physi. 344 or 350 and consent of department chairperson. Continuation of Physi. 350.
399. *Special Topics. I, II, S.* 1-4 hr. PR: Consent. Assigned study designed to develop research skills.
444. *Graduate Seminar. I, II.* 2 hr. PR: Graduate status and consent. (Graded as S or U.)
490. *Teaching Practicum. I, II.* 1-3 hr. PR: Consent. Supervised practices in college teaching of physiology. (Graded as S or U.)
491. *Advanced Physiology. I, II, S.* 1-15 hr. PR: Consent. Lecture-conference in: cellular physiology, neurophysiology, circulation, respiration, acid-base and renal physiology, digestion and energy metabolism, and endocrinology. 3 lec., 3 conf.
497. *Research in Physiology. I, II, S.* 1-15 hr.
498. *Thesis. I, II, S.* 2-4 hr. PR: Consent. (Graded as S or U.)
499. *Graduate Colloquium. I, II.* 1-6 hr. PR: Consent. (Graded as S or U.)

PLANT PATHOLOGY

William L. MacDonald, In Charge of the Graduate Program in Plant Pathology
528 Brooks Hall

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Adams, Gallegly, MacDonald, Stelzig, and Young. Associate Members Hindal and Quinn.

Graduate studies in Plant Pathology leading to the M.S. and Ph.D. degrees deal with the many aspects of the biology and control of plant diseases. The teaching and research faculty is composed of six full-time members with special interests in the areas of forage, ornamental, forest, vegetable and fruit-tree pathology, as well as mycology and disease physiology.

Graduate training is designed to offer qualified students a broad background in the agricultural sciences through cooperation with other disciplines in the College of Agriculture and Forestry, College of Arts and Sciences, and School of Medicine.

The primary objective of the research and training program is to provide students with training for professional careers in plant pathology or other biology-related areas.

A thesis (M.S.) or dissertation (Ph.D.) is required. Course work and research problems are designed by the student, the graduate adviser, and the advisory committee.

Plant Pathology (P. Pth.)

201. *General Plant Pathology. I.* 4 hr. Nature and causes of plant diseases; methods of control.
301. *Diseases of Economic Plants. I, II, S.* 1-3 hr. per sem., 2 hr. in Summer. PR: P. Pth. 201 or 303 or consent. Recognition, cause, and control of diseases of economic plants; Sem. I, Diseases of vegetable crops and of tree and small fruits; Sem. II,

Diseases of ornamental plants and field and forage crops; S, Diseases of forest trees. Students may register for 1-3 hr. in Sem. I and II, 2 hr. in Summer, until 8 hours of credit are accumulated. (*Offered in 1983-84 and in alternate years.*)

302. *Principles of Plant Pathology*. II. 4 hr. PR: P. Pth. 153, 201, or 303, or consent. Primarily for graduate students and seniors majoring in biology, botany or agricultural science. Nature of disease in plants with practice in laboratory methods. (*Offered in Spring of even years.*)
303. *Mycology*. I. 4 hr. Lectures and field and laboratory studies of parasitic and saprophytic fungi.
309. *Nematology*. II. 3 hr. Primarily for graduate students majoring in the agricultural sciences or biology. Nematode taxonomy, bionomics, and control, with particular emphasis on plant parasitic forms. (*Offered in Spring of odd years.*)
402. *Physiology of Plant Diseases*. I. 2 hr. PR: Ag. Bi. 291 and P. Pth. 302, or consent. Study of host-parasite interactions, with emphasis on physiological and biochemical changes that occur in higher plant tissues in response to pathogenic organisms. (*Offered in Fall of even years.*)
430. *Physiology of the Fungi*. II. 4 hr. PR: Organic chemistry, mycology, and bacteriology, or consent. Physiological aspects of growth, reproduction, and parasitism of fungi, with emphasis on nutrition, environment, and other biotic factors. (*Offered in Spring of even years.*)
440. *Taxonomy of the Fungi*. S. 3 hr. PR: P. Pth. 303. Collection and identification of fungi with emphasis upon those of economic importance. (*Offered in Summer of odd years.*)

Plant Science (Pl. Sc.)

200. *Recognition and Diagnosis of Plant Disorders*. I. 4 hr. PR: P. Pth. 201 and Ento. 204. Creates an ability for the student to use systematic inspection to determine cause or causes of a plant disorder.
201. *Principles and Methods of Plant Pest Control*. II. 4 hr. PR: P. Pth. 201 and Ento. 204. Concepts of control and how they are implemented by exclusion, eradication, protection, and immunization.
420. *Special Topics*. I, II, S. 2-6 hr. Special study in agricultural microbiology, crop science, entomology, horticulture, plant pathology, or soil science.
450. *Seminar*. I, II. 1 hr. Graduate seminar in agricultural microbiology, crop science, horticulture, plant pathology, or soil science.
497. *Research*. I, II, S. 1-15 hr. Graduate research in agricultural microbiology, crop science, horticulture, plant pathology, or soil science.

POLITICAL SCIENCE

Orrin B. Conaway, Jr., Chairperson of the Department

316-A Woodburn Hall

Degrees Offered: M.A., Ph.D.

Graduate Faculty: Members Conaway, Gilkey, Jacobsohn, Kim, Menzel, Mertins, Peterson, Rice, Temple, Whisker, Wilcox, D. G. Williams, J. R. Williams, and Yeager. Associate Members Bingham, DiClerico, Hammock, Pops, and Wolf.

The Master of Arts (M.A.) and Doctor of Philosophy (Ph.D.) programs in political science are designed to give advanced training to students who desire a Public Policy career in government or who wish to enter selected teaching or research fields with a specialization in Public Policy.

Master of Arts (Public Policy)

The Master of Arts (Public Policy) is offered jointly by the Department of Political Science and the Department of Economics. It is designed to: (a) train students in the fields of political science (public policy) and economics; (b) provide students with the analytical and research skills that are necessary to conduct research on applied policy problems; and (c) provide field experience on an optional basis through a practicum or internship in a public or private agency. Graduates are capable of working in private or governmental agencies that have a need for persons who understand and can apply economic and policy analysis approaches to the everyday problems confronting the public, private groups, and/or state, local, and national governments.

Eligibility. Applicants for the Master of Arts degree (Public Policy) should have a B.A. in Political Science (with a minimum of 6 hours in Economics) or a B.A. or B.S. in Economics (with a minimum of 6 hours in Political Science). In addition, the applicant should have an overall grade-point average of 2.75, and should submit two letters of recommendation from faculty familiar with the student's work. Students must also submit Graduate Record Examination (General Aptitude) test scores.

Course Requirements. To have a good standing in the M.A. program, a student must maintain an average of 3.0 each semester.

Admission to candidacy for the M.A. degree requires that the student complete a minimum of 36 hours (exclusive of Colloquium) in a specialized curriculum offered by the Department of Political Science and the Department of Economics. This curriculum includes courses in Micro and Macro Economics, Regional Economics, State and Local Government, Intergovernmental Relations, and Public Policy Analysis. In addition, students must complete work in Political Science Methodology and Statistical Methods. All students must enroll in Pol. S. 499, Colloquium, each semester in residence.

The M.A. degree provides an optional Research Practicum during the fourth semester of work. The practicum enables the student to conduct actual policy research in a public agency. The practicum will carry an additional 6 hours of graduate credit.

Final Examinations. Students will be expected to pass final written/oral examinations in two fields — Economics and Policy Analysis. Students who fail examinations may be allowed to take them at the next regularly scheduled examination period. It is contrary to departmental policy to give a third examination.

Doctor of Philosophy (Public Policy)

The Doctor of Philosophy (Ph.D.) program is designed for persons who desire teaching and research careers or careers in public sector management and policy analysis.

The principal change in the discipline of political science in recent years has been increasing attention to and involvement with public policies. The Department of Political Science has revised its Ph.D. program to take account of this change. The department believes that a Ph.D. recipient of the future should possess a comprehensive knowledge of political science as it relates to the formulation, implementation, and evaluation of public policies. This requires a thorough understanding of political dynamics and institutions; a knowledge of management tools and data management; and competence in research method-

ology and statistical techniques. Further, familiarity with a policy field and the contributions of related disciplines, particularly economics, are distinct advantages to both the teacher-research and the policy analyst-manager.

Resources for Graduate Study. The Department of Political Science has 18 full-time faculty members. More than half of these faculty members are teaching in the Policy Studies graduate programs. In addition, faculty in the Departments of Public Administration and Economics teach in the M.A. and Ph.D. curriculums.

Graduate students have opportunities to perform research with the Policy Analysis Group, with individual faculty members, and on research grants. Opportunities exist for field experience in various governmental agencies.

Admission. Admission to the Ph.D. program is open to students with either a bachelor's or a master's degree. Students with degrees in political science, economics, public administration, sociology, psychology, engineering, social work, business, law, medicine, or journalism are encouraged to apply. An undergraduate applicant should have a grade-point average of 3.0; a graduate applicant an average of 3.5. In addition, all applicants must submit the results of the Graduate Record Examination and at least three letters of recommendations from faculty persons familiar with the applicant's work. Admission will be based on an overall assessment of the individual's record.

The work of all individuals admitted to the doctoral program will be formally evaluated at the end of the first two semesters (at least 18 credit hours of study) at which time one of the following recommendations will be made: (1) admission to candidacy for the doctoral degree; (2) admission to the Master's degree program in public policy studies; or (3) termination.

Course Requirements. The program of each person admitted to the doctoral program will be designed in accordance with his/her career objectives and previous training. (A complete description of the Ph.D. program and course requirements may be obtained by writing the Director of Graduate Studies, Department of Political Science, West Virginia University, Morgantown, WV 26506. This should be done before application to the Graduate School.) However, the following constitute the formal minimum requirements of the program:

I. Public Policy Core (18 hours).

II. Policy Research Methods (6 hours).

III. Economics (6 hours).

IV. Policy Field (12 hours).

V. Elective Sub-field of Specialization (9-12 hours).

VI. Tool Skills (9 hours).

VII. A dissertation in accordance with individual career goals (24-27 hours).

VIII. Passage of comprehensive written and oral examinations.

To have good standing in the doctoral program, a student must maintain a minimum grade-point average of 3.0 in political science each semester. Students are required to spend at least one year (two semesters) in residence enrolled in a full-time graduate program of no less than 9 semester hours each semester. All graduate students must enroll in Pol. S. 499, Colloquium, each semester in residence.

Financial Assistance

The Department has a number of assistantships and fellowships available for students in the public policy specialization. Students interested in financial

assistance should apply directly to the Department of Political Science. Graduate assistants may enroll for no more than 9 credit hours per semester.

Political Science (Pol. S.)

200. *Quantitative Political Analysis*. I, II. 3 hr. PR: Upper-division standing. Course stresses the understanding of methods, theories, and substantive interests identified with behavioral approach to the study of politics. Descriptive statistics and the use of the University of Chicago's Statistical Package for the Social Sciences (SPSS) are included.
210. *The American Presidency*. I, II. 3 hr. Institutional, behavioral and societal forces which have given rise to the modern presidency; factors which enhance and constrain the exercise of the presidential power over those constituencies with which the president must interact; the nature and consequences of the presidential decision-making process; desirability and/or feasibility of reforming the presidency.
211. *Problems of American National Government*. I, II. 3 hr. An examination of selected problems in American government and politics.
213. *American Constitutional Law*. I. 3 hr. PR: Pol. S. 2 or consent. (Primarily for juniors and seniors as well as graduate students.) Basic principles of American constitutional law as developed through court interpretations based on precedents rooted in an English-derived colonial heritage. Special emphasis on the division and separation of powers, the implementation of rights by court decisions expanding their effect through "incorporation," and the strategic significance of judicial review. Major constitutional controversies as treated by courts and judges are examined in the light of the facts and from the standpoint of theory in order to reach tenable conclusions as to the role of the judiciary in America. Case method of instruction.
214. *Civil Rights and Liberties in the United States*. II. 3 hr. PR: Pol. S. 213 or consent. The scope and meaning of civil liberty guarantees in the United States Constitution, as illustrated by cases involving original constitutional provisions, the Bill of Rights, and Civil War amendments with special attention to the rule of law; free speech, press, religion, assembly, and petition; personal security; racial discrimination; and the labor problem.
215. *American Constitutional Development I*. I. 3 hr. PR: Pol. S. 2 or consent. American constitutional development, with special emphasis on origins of constitutionalism here; liberty vs. government; mixed government; separation of powers; problem of federalism and Philadelphia Convention of 1781; Marshall court and establishment of judicial review; Federalist vs. States Rights construction of Constitution; Jacksonian influences; Taney Court prelude to Civil War, secession, and conflict heralding constitutional change.
216. *American Constitutional Development II*. II. 3 hr. PR: Pol. S. 2, 215, or consent. American constitutional development, with special attention to reconstruction, Supreme Court, and Fourteenth Amendment; *Laissez-faire* and commerce clause; stirrings of reform toward a constitutional revolution under New Deal; changing federal-state relationships; impact of war on constitutional interpretation; expanding role of the president in domestic matters and foreign relations; the Warren Court, the Burger Court dominated by Nixon-Ford judges.
221. *West Virginia Government and Administration*. I, II. 3 hr. Organization and operation of the state government of West Virginia.
225. *Municipal Government*. I. 3 hr. Legal basis, structure, processes and politics of urban governments and cooperative-conflict relations with other governmental units.
226. *Problems of State and Local Government*. I, II. 3 hr. PR: Pol. S. 120 or equiv. Change processes in state and local systems in the context of federalism.

232. *Public Opinion and Propaganda*. I, II. 3 hr. The formation, measurement, and impact of public opinion in the American and cross-national contexts.
233. *Current Political Issues*. I. 3 hr.
234. *The Legislative Process*. II. 3 hr. Structure and organization of legislative bodies. Powers of legislature. Detailed study of law-making procedures. Influence of outside forces.
236. *Energy/Environmental Policies and Politics*. II. 3 hr. PR: Pol. S. 2, 120, or 135. Focus on U.S. policies, programs, and politics in the energy and environmental areas.
240. *Public Administration and Social Change*. I, II. 3 hr. PR: Pol. S. 140. The study of government and administrative organization in their relationships to the sources of change — social, cultural, economic, technological, and environmental — in American society.
242. *American Administrative Systems*. I. 3 hr. Analysis of the nature and processes of American public administration (political, legal, economic, and social conditions), including the role of the bureaucracy in a democracy. (Equiv. to Pub. A. 242.)
244. *Administrative Law and Regulation*. II. 3 hr. PR: Pol. S. 140 or consent. The law of public administration, primarily by case method, covering administrative powers and limitations, procedure in administrative adjudication and rule-making, discretion, ultra vires as check on administrators, notice and hearing, administrative penalties, judicial control and administrative liability.
246. *Comparative Public Administration*. II. 3 hr. Theory and practice of public administration in diverse cultures and national political systems.
250. *Government of Japan*. II. 3 hr. Survey of political institutions and governmental process of Japan with special emphasis on the analysis of political problems in the postwar period.
251. *Government of Soviet Union and Eastern Europe*. II. 3 hr. PR: Pol. S. 1 or 2. Survey of the political non-democratic governments of the Soviet Union and its Eastern European satellites, with special reference to the guiding role and development of Marxism-Leninism.
252. *British Government and Politics*. II. 3 hr. Intensive study of British government with emphasis on internal and external policies, primarily during twentieth century.
253. *Contemporary Governments of the Commonwealth*. II. 3 hr. Political relationships between members of Commonwealth. comparative study of governments and politics of the dominions, with particular reference to Canada and Australia.
254. *Government of China*. I. 3 hr. Survey of political institutions, and governmental process of Communist China with a special emphasis on the analysis of political problems since 1949.
255. *Governments of Latin America*. I. 3 hr. Comparative study of the major nations of Latin America.
256. *Governments of the Middle East*. II. 3 hr. Governments and political forces of the Middle East.
258. *Politics of Africa*. II. 3 hr. Historical legacies and current political processes of tropical African countries.
261. *International Organization*. II. 3 hr. Agencies created since close of World War II. Some reference to development of international law and United Nations.
263. *Public International Law*. I. 3 hr. Law governing relations among nations, including development of rules, means of enforcement, and conflicts between theory and practice.

264. *Conduct of American Foreign Relations. I.* 3 hr. Concepts about and factors influencing the formulation and execution of United States foreign relations; analysis of past policies and current issue areas in relations with major developed and developing nations and international organizations.
266. *Soviet Foreign Policy. II.* 3 hr. Concepts about and factors influencing the formulation and execution of Soviet foreign relations; analysis of past policies and current issue areas in relations with major developed and developing nations and international organizations.
267. *Latin America in International Affairs. II.* 3 hr. Relations of Latin American states among themselves, with the United States, the United Nations, regional organizations, and non-western states. Analysis in depth of the Monroe Doctrine and its corollaries, and the inter-American system.
269. *Far Eastern International Relations. II.* 3 hr. International relations of Far Eastern countries with emphasis on historic roots of recent conflicts, the competitive role of the United States and the Soviet Union, confrontation between the communist and anticommunist countries in the region, and the regional cooperation and security problems in the post-war period.
270. *History of Political Thought: Plato to Machiavelli. I.* 3 hr. Major political ideas from the Greeks to sixteenth century with special emphasis upon development of natural law and western conception of justice.
271. *History of Political Thought: Machiavelli to Bentham. II.* 3 hr. PR: Pol. S. 270 or consent. Political ideas which developed from the separation of faith and reason, the culmination of this movement in rational integral liberalism, and the origins of modern conservatism as expounded by Edmund Burke.
272. *Recent and Contemporary Political Thought. I.* 3 hr. Examination of integral liberalism and the forces leading to the decline of liberalism and a critical analysis of the fascist and communist ideologies with their threat to the traditions of western civilization embodied in Christianity and conservatism.
273. *American Political Theory. I, II.* 3 hr. Major political ideas and their influence upon American society and government from seventeenth century to present.
275. *Foundations of Jurisprudence. II.* 3 hr. Inquiry into: (a) nature, end, and sanctions of law; its sources, forms, and modes of growth, as evidenced in typical legal systems; general juristic conceptions of rights, duties, and liabilities as well as persons, acts, and things; (b) main schools of jurisprudence — analytical, historical, philosophical, sociological, and that of legal realism; (c) economic interpretation of law and its relation to property and interest; (d) problem of legal rule versus discretion; (e) meaning of obligation, with special reference to contract; (f) stages in the development of legal institutions, forms and procedures (as exemplified in trials); (g) significant theories about law including the Marxian "aberration," and (h) status of law in today's world.
279. *Analysis of Political Behavior. II.* 3 hr. Examines political behavior in terms of recent behavior theories emanating from a variety of disciplines.
299. *Special Topics. I, II.* 1-3 hr.
300. *Introduction to Political Science Methodology. I.* 3 hr. An introduction to the various research methods and techniques used in public analysis. Areas covered include: the logic of inquiry, research design, measurement techniques, survey and unobtrusive research, and data analysis.
310. *Intergovernmental Relations. I.* 3 hr. Analyzes the development of traditional American Federalism and its evolution into modern "intergovernmental relations." The inquiry extends to the theory and practice of the "new federalism," including its statutes, regulations, procedures, and institutions.

335. *Theory of Public Policy Development*. II. 3 hr. PR: Pol. S. 235 or equiv. Review and assessment of current efforts to develop theories of public choice in the American political system. The role of the policy analyst is examined.
336. *Politics of Agenda Setting*. II. 3 hr. Examines the confluence of social, economic, and political influences on the development of public problems and their placement on the policy agenda.
345. *Public Administration and Policy Development*. II. 3 hr. PR: Pol. S. 140 or consent. Decision-making and policy development in the administrative process by the case method.
350. *Proseminar in Comparative Politics*. I. 3 hr. PR: Graduate standing. A survey of traditional, contemporary deductive, and contemporary inductive approaches to comparative politics, with particular attention to recent cross-national methodologies and research findings. (Course will not be offered in 1981-82.)
351. *Politics of Planned Development*. I. 3 hr. Political aspects of social, economic, and technological change, with special reference to the politics of development planning and administration.
360. *Proseminar in International Relations*. I. 3 hr. PR: Graduate standing. An intensive and systematic critical analysis of contemporary theory and research representative of the major foci in international relations. (Course will not be offered in 1981-82.)
370. *Proseminar in Political Theory*. II. 3 hr. PR: Pol. S. 270, 271, or consent. A survey course designed for graduate students which covers the major trends within political theory. Perennial questions of political theory, such as property, liberty, state power, and the good political system. (Course will not be offered in 1981-82.)
400. *Scope and Methods of Political Science*. II. 3 hr. PR: Pol. S. 300 or consent.
403. *Internship*. I, II. 6-9 hr. per sem; students may enroll more than once. PR: Consent.
- 410, 411. *Directed Reading and Research in American National Government*. I, II. 2-4 hr. per sem.; students may enroll more than once.
419. *Seminar in American National Government*. I, II. 3 hr. PR: Consent.
- 420, 421. *Directed Reading and Research in State Government*. I, II. 2-4 hr. per sem; students may enroll more than once.
- 425, 426. *Directed Reading and Research in Local Government*. I, II. 2-4 hr. per sem.; students may enroll more than once. PR: Pol. S. 225 or consent.
429. *Seminar in State and Local Government*. I, II. 3 hr. PR: Consent.
- 430, 431. *Directed Reading and Research in Politics*. I, II. 2-4 hr. per sem.; students may enroll more than once. PR: Pol. S. 130 or consent.
435. *Public Policy Evaluation Research*. II. 3 hr. Methods and techniques in evaluating public policies. Topics include the relation of policy analysis to policy making; types of evaluation; alternative evaluation designs; measuring program consequences; problems of utilization; and the setting of evaluation research.
439. *Seminar in Policy Analysis*. I. 3 hr. PR: Pol. S. 335 or consent.
- 440, 441. *Directed Reading and Research in Public Administration*. I, II. 2-4 hr. per sem.; students may enroll more than once. PR: Pol. S. 140 or consent.
- 450, 451. *Directed Reading and Research in Comparative Government*. I, II. 2-4 hr. per sem.; students may enroll more than once.
459. *Seminar in Comparative Government*. II. 3 hr. PR: Consent.

- 460, 461. *Directed Reading and Research in International Relations*. I, II. 2-4 hr. per sem.; students may enroll more than once.
469. *Seminar in International Relations*. II. 3 hr. PR: Consent.
- 470, 471. *Directed Reading and Research in Political Theory*. I, II. 2-4 hr. per sem.; students may enroll more than once.
479. *Seminar in Political Theory*. I. 3 hr. PR: Consent.
480. *Thesis*. I, II. 2-6 hr.
497. *Research*. 1-15 hr.
499. *Colloquium*. I, II. 1-6 hr.

PROFESSIONAL ACCOUNTANCY

Jay H. Coats, *Director of Graduate Program in Accounting*
302 Armstrong Hall

Degree Offered: M.P.A.

Graduate Faculty: Members Coats, Givens, Maust, Neidermeyer, Shaw. Associate Member G. S. Smith.

To obtain approval for entry into the M.P.A. program an applicant must have a baccalaureate degree from an accredited college or university with an undergraduate grade-point average of at least 2.5 (of a possible 4.0). In addition, the applicant is required to submit an acceptable score on the Graduate Management Admission Test (GMAT). A minimum score of 450 is satisfactory for applicants who have an undergraduate grade-point average of at least 3.0. A lower grade-point average will require a higher GMAT score. In exceptional cases, a student with a grade-point average between 2.25 and 2.5, or a student who has not taken the GMAT, may be admitted on a Special-Provisional basis.

To assure that all students in the program have the same foundation in business, the following prerequisite courses, or their equivalent, must be completed before enrolling in M.P.A. graduate courses: Principles of Accounting (6 hours), Intermediate Accounting (6 hours), Advanced Accounting, Cost Accounting, Tax Accounting, Auditing or Accounting Systems, Principles of Economics, Principles of Marketing, Principles of Management, Principles of Finance, Statistics, Business Law, and Computer Science.

A student without the necessary prerequisite courses may be approved to enter the M.P.A. program as a Regular Graduate Student with Deficiencies. Deficiencies must be removed before taking the required graduate courses. All applications for approval to enter the M.P.A. program must be received in the WVU Office of Admissions and Records as early as possible and no later than one month before the date for which enrollment is requested.

Master of Professional Accountancy (M.P.A.)

The candidate's program will be planned with the assistance and approval of a faculty adviser. The M.P.A. degree requires 36 hours of graduate credit, including the following courses:

Accounting 310 — Financial Accounting Theory and Practice. 3 hr.

Accounting 317 — Auditing and Professional Accounting Standards. 3 hr.

Accounting 329 — Seminar in Accounting. 3 hr.

Economics 301 — Managerial Economics. 3 hr.

Finance 313 — Corporate Financial Administration. 3 hr.

Management 301 — Organization Theory. 3 hr.

Management 302 — Quantitative Business Analysis. 3 hr.

The candidate also will complete 9 semester hours of elective accounting courses and 6 hours of accounting or nonaccounting courses selected with the approval of the faculty adviser. No thesis is required, but writing is emphasized in all courses.

The M.P.A. program requires that the student maintains a grade-point average of at least 3.0 on all work taken as a graduate student while enrolled in the College of Business and Economics, including prescribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.75 will be placed on probation. If the average is not brought up to 2.75 by the end of the following semester, the student will be suspended from the program. A grade below C in any course taken while enrolled as a graduate student will result in suspension from the graduate program. In addition, the student must maintain a 3.0 average in all work counting toward the graduate degree.

Complete information about the M.P.A. program may be obtained by securing a copy of the M.P.A. bulletin from the Director of Graduate Programs in Business.

Accounting (Acctg.)

200. *Special Topics*. I, II, S. 1-4 hr. PR: Acctg. 112 or consent. Special topics relevant to accounting. Maximum of 9 semester hours in any or all courses numbered 200 offered by the College may be applied toward bachelor's and master's degrees.
210. *Advanced Accounting*. I, II. 3 hr. PR: Grade of C or better in Acctg. 112, or written consent. Accounting for partnerships, consolidations, foreign exchanges, and governmental (nonprofit) entities.
211. *Accounting Systems*. I. 3 hr. PR: Com. S. 1, Acctg. 115 or 116. Analysis of data processing fundamentals and information systems analysis, design, and implementation, including necessary computer hardware and software components with particular reference to accounting information systems and the controls necessary there-in.
213. *Income Tax Accounting*. I. 3 hr. PR: Acctg. 111 or 115 or 116 or consent. Tax laws and the investment and decisions they affect. Taxes are presented in meaningful relationships in order to form a general pattern of knowledge that is easier understood.
214. *Income Tax Accounting*. II. 3 hr. PR: Acctg. 111 or 115 or 116 or consent. Emphasis on income tax practice as developed from the Internal Revenue Code, regulations, rulings and court decisions. Cases and problems covering individuals, partnerships, corporations, and estate and gift returns.
216. *Advanced Managerial Accounting*. II. 3 hr. PR: Acctg. 115 or Econ. 125. Special problems in cost accounting, including tax planning, inventory control, and decision models on CPA/CMA examination. Selected problems and cases will be used.
217. *Auditing Theory*. I or II. 3 hr. PR or Conc.: Acctg. 210. Auditing fundamentals; objectives, ethics, statistical samplings, standards and procedures. Emphasis on FASB and SAS disclosures.
218. *Auditing Practice*. I or II. 3 hr. PR: Consent. Application of auditing theory and procedures, with emphasis on decisions which invoke judgment and are important in independent audits; audit working papers and reports; case studies. (Course will not be offered in 1981-82.)

224. *Advanced Accounting Problems*. I or II. 3 hr. PR: Minimum of 18 hr. in accounting with an average grade of B or higher. Analysis and solution of representative C.P.A. problems. *(Course will not be offered in 1981-82.)*
230. *Advanced Accounting Theory*. I or II. 3 hr. PR: Acctg. 112, 115 and consent. Critical analysis of accounting concepts and standards with emphasis on their origin, development, and significance. *(Course will not be offered in 1981-82.)*
299. *Independent Study*. I, II. S. 1-3 hr. PR: Consent. Students will develop and complete a program of specialized studies under the supervision of a cooperating instructor.
301. *Managerial Control*. 3 hr. PR: Acctg. 52. Use and significance of quantitative techniques of accounting, statistics, and budgeting for planning, and decision making.
310. *Financial Accounting Theory and Practice*. I. 3 hr. PR: Acctg. 112. Comprehensive examination of financial accounting theory as established by the opinions, statements, and interpretations of professional organizations with special emphasis on their application and problem solving.
312. *Accounting Information Systems*. S. 3 hr. PR: Acctg. 211 or consent. Accounting information systems as a means of measurement, communication, and control of business activities. Design, control, evaluation, and auditing of computerized accounting systems.
313. *Income Taxes and Business Decisions*. II. 3 hr. PR: Acctg. 213. Advanced federal income-tax problems with emphasis on tax planning for business decisions and tax research methodology.
317. *Auditing and Professional Accounting Standards*. S. 3 hr. PR: Acctg. 217. Professional objectives, principles, and standards of auditing; audit reports and related communications; and case studies of audit sampling, professional ethics, legal liability, and reporting.
320. *Controllership*. II. 3 hr. PR: Acctg. 112 and 115 or 301. Examination of the role of the controller in large entities in planning, measuring, evaluating, and controlling performance and in reporting to stockholders and governmental agencies.
322. *Governmental and Nonprofit Accounting*. II. 3 hr. PR: Acctg. 112. Fund accounting and control in governmental and nonprofit entities; identification and control of cost centers; cost analysis and cost centers; cost analysis and cost finding, and planning and control of operations and resources. *(Course will not be offered in 1981-82.)*
324. *Evolution of Accounting Thought*. I. 3 hr. PR: Acctg. 112. Evolution of accounting thought with emphasis placed on the influence of the past upon present accounting theory and professional practice. *(Course will not be offered in 1981-82.)*
326. *Reporting Practices and Problems*. S. 3 hr. Evaluation of financial reporting practices and trends, including an examination of the reporting requirements of the SEC and other regulatory agencies. Practitioners will be used extensively for class discussion and presentations. *(Course will not be offered in 1981-82.)*
329. *Seminar in Accounting*. 3 hr.
491. *Advanced Study*. 1-6 hr.

PSYCHOLOGY

Jon E. Krapfl, Chairperson of the Department

101-A Oglebay Hall

Degrees Offered: M.A., Ph.D.

Graduate Faculty: Members Caldwell, Callahan, Carruth, Cohen, Comer, Cone, Detan, Edelstein, Fremouw, Goodman, Hake, Hawkins, Hutchinson, Hursh, Krapfl, Lattal, Miller, Parker, Quarrick, Reese, Shafer, Turner and Walls. Associate Members Foster, McCluskey, and McSweeney.

Admission. Students are admitted only at the beginning of the first semester. Application must be completed by the preceding February 15. Acceptance will be based on: (1) adequate academic aptitude at the graduate level as measured by the Graduate Record Examination; (2) a minimum grade-point average of 3.0 (B); (3) personal qualities in the applicant which are predictive of success in graduate study and satisfactory professional placement after graduation; (4) adequate preparation in the biological and social sciences, experimental psychology, and statistics. By permission, deficiencies in preparation may be made up after admission to the department. Students are expected to maintain a 3.0 (B) average in their psychology courses during the first graduate year, and to present a final 3.0 average in all psychology courses attempted.

Special Graduate Students. Graduate courses in psychology are open only to regular graduate students except by special departmental permission.

Master of Arts Degree (M.A.). Two years of full-time study with a minimum of 48 hours of credit are required for the M.A. degree. Six hours of credit may be counted for the M.A. thesis if such thesis is required by the option chosen by the student. The following options are available for the M.A. degree:

1. **Intermediate Degree for Ph.D. Candidates.** Students who are candidates for the Ph.D. are expected to complete an M.A. thesis and will receive the M.A. degree upon completing the thesis and credit hour requirements.

2. **Professional M.A. Degree in Clinical Psychology.** This program prepares the student for work in mental hospitals, mental health clinics, school mental health programs, and the like. No thesis is required.

Doctor of Philosophy Degree (Ph.D.). The doctoral programs aim to prepare a small number of well-qualified psychologists for three types of careers: (1) teaching and research in behavior analysis; (2) teaching and research in lifespan developmental psychology; and (3) teaching, research, and practice in systems or clinical psychology. A calendar year in an approved internship setting is required of all clinical and systems students.

Students are accepted for study toward the Ph.D. degree upon entry into the department. They are formally admitted to doctoral study only after completion of the master's degree or its equivalent and may be subject to a screening examination to determine their readiness for doctoral work. During the first year of graduate work beyond the master's degree, the student will be admitted to a comprehensive preliminary examination in which competence must be demonstrated in the major area of specialization and a knowledge of such other areas of psychology as may be required of all graduate psychology students.

Upon passing the preliminary examination, the student will be formally promoted to candidacy for the doctorate. The student will then be assigned a committee which directs dissertation research. For those students required to complete an internship as a part of their training, the internship setting must be

approved by the appropriate program committee. In the clinical psychology programs, the internship may be approved by the program committee or by the Director of Clinical Training.

After completion of a satisfactory dissertation and all other requirements, the candidate will take a final examination, written or oral, concerning the major emphasis and the dissertation.

Psychology (Psych.)

- 213. *Directed Studies*. I, II, S. 1-3 hr. PR: Consent. Individually supervised reading, research and/or classroom management projects. No more than 12 hours may be applied to the 42 hours of psychology to which majors are limited.
- 218. *History and Systems of Psychology*. II. 3 hr. A survey of psychology from its origins in philosophy, biology, and physics through the several major schools of psychological thought to modern perspectives of behavior. Recommended especially for students planning graduate study in psychology.
- 219. *Psychology As a Profession*. II. 1 hr. PR: Psychology major. Orientation to opportunities for experience, employment, and graduate and professional training in psychology. Especially recommended for second-semester sophomores and juniors. (Offered only on Pass/Fail basis.)
- 223. *Learning and Memory*. I. 3 hr. Theoretical and empirical issues in human and animal learning and memory with emphasis of memory, language, verbal behavior, and conceptual processes.
- 224. *Experimental Analysis of Behavior*. I and II. 3 hr. Laboratory and lectures survey research in operant conditioning and its implications for behavior theory and applications.
- 225. *Cognition and Perception*. I and II, S. 3 hr. Current issues and theory in human perception, thinking, language, and information processing.
- 232. *Physiological Psychology*. I. 3 hr. Introduction to the biological foundations and the physiological mechanisms of behavior.
- 242. *Prenatal and Infant Behavior*. I, S. 3 hr. Early influences upon behavior and development are investigated; topics include behavioral genetics, hazards of parental development, sensor and motor development, language development, and socio-emotional development.
- 243. *Child and Adolescent Behavior*. II, S. 3 hr. Theory and research on the major psychological processes in childhood and adolescence are explored including maturation, personality, socialization, sensory and cognitive development.
- 245. *Adulthood and Aging*. I or II. 3 hr. Cognition and personality changes from maturity to old age. Psychological reactions to physiological change and to the establishment and dissolution of family units. Problems of intergenerational differences in adult behavior.
- 251. *Social Psychology*. II. 3 hr. Social factors which determine human behavior. Survey of the results of laboratory research in social psychology and its implications for social phenomena.
- 262. *Assessment of Behavior*. II. 3 hr. Theory and practice in development and use of psychological assessment procedures. Includes intelligence testing, behavioral assessment, interviewing. Completion of Stat. 101, or its equivalent, is recommended.
- 263. *Comparative Personality Theory*. I, II. 3 hr. Theoretical and empirical readings in a comparative survey of major perspectives in personality theory, including dynamic, cognitive, humanistic, and behavioral theories of personality.

264. *Psychology of Adjustment*. II. 3 hr. Dynamic principles of human personality adjustment.
274. *Survey of Behavior Modification*. I and II. 3 hr. Behavior therapy and modification including desensitization, covert sensitization, interpersonal skill training; aversion techniques and applied behavior analysis employing operant principles.
279. *Community Psychology*. I. 3 hr. Psychological principles applied to treatment and intervention strategies at the community level. Manpower development, organizational change, and systems analysis.
281. *Abnormal Psychology*. I and II. 3 hr. Major categories of behavioral disorders, e.g., neuroses, psychoses, and character disorders are considered in terms of etiology, treatment, outcome, and prevention.
282. *Exceptional Children*. I or II. 3 hr. Study of children who present psychological problems: (1) exceptional mental retardation or advancement; (2) organic disabilities having behavioral consequences, such as cerebral palsy or deafness; (3) behavior disorders.
297. *Honors Investigation and Thesis*. I, II. 3 hr. (May be repeated for credit; max. credit 6 hr.) Supervised readings and investigation culminating in the honors thesis.
301. *Personnel Psychology*. I or II. 3 hr. PR: Stat. 101, or equiv. Application of psychological principles and techniques to the problems of measurement and prediction of proficiency in industry and society. (Course will not be offered in 1981-82.)
304. *Leadership and Human Relations in Working Groups*. I or II. 1-3 hr. PR: Consent. Individual work related to either research or practice in the field of human relations training programs. (Course will not be offered in 1981-82.)
307. *Practicum in Industrial Interviewing*. I or II. 3 hr. PR: Psych. 201 or consent. Intensive review of principles of selection and validation. Practice interviews applying non-directive techniques in employment and other types of interview.
311. *Research Design and Data Analysis I*. I. 3 hr. Principles of experimental design in psychology including group and single subject methodologies. Topics include: (a) internal and external validity; (b) analysis of variance with single factor, factorial and mixed research designs; and (c) reversal and multiple baseline designs.
312. *Research Design and Data Analysis II*. II. 3 hr. PR: Psych. 311 or consent. Inferential statistics, simple correlation and regression, multiple correlation and regression, partial correlation, analysis of covariance, analysis of variance of designs with unequal cell sizes.
313. *Directed Study*. I, II, S. 1-3 hr. per sem. PR: Consent. Directed reading and research in special areas. (Undergraduates register for such projects under Psych. 213.)
315. *Multivariate Analysis*. I or II. 3 hr. PR: Psych. 311, or equiv., and consent. Correlation methods in psychology with application to typical research problems. Includes simple matrix algebra, multiple correlation, discriminant analysis, and an introduction to factor analysis. (Equiv. to Stat. 341.)
316. *Correlational and Quasi-Experimental Designs*. I. (Alternate Years.) 3 hr. PR: Psych. 311 and 312 or equiv. Consideration of the methods, measurement, and analysis of non-experimental research. Includes survey, correlational, and quasi-experimental designs; questionnaire and attitude scale construction; nonreactive measurement techniques; and data analysis.
318. *Ethical and Legal Issues*. II. 2 hr. The ethical standards for psychologists are applied to research and clinical problems. The legal regulations and contemporary issues in mental health are studied.
325. *Behavior Analysis I*. I. 3 hr. PR: Graduate standing in psychology or consent. Conceptual, methodological, and empirical issues in the psychology of learning with

- emphasis on positive reinforcement and stimulus control. Includes laboratory work with animals.
326. *Behavior Analysis II*. II. 1 hr. PR: Psych. 325. A continuation of Psych. 325. Theory and research in aversive control of behavior, including negative reinforcement, punishment, and conditioned suppression. (*Course will not be offered in 1981-82.*)
 327. *Behavior Analysis III*. II. 2 hr. PR: Psych. 325 and 326. Basic learning principles discovered with animals are extended to basic human research with emphasis upon: (1) ways the procedures and situations might be modified for human research, and (2) phenomena that are specific to humans.
 340. *Advanced Developmental Issues and Methodology*. II. 3 hr. Developmental issues including historical perspectives, validity, theoretical systems, and growth models will be presented along with research methods and designs employed in life-span developmental psychology.
 344. *Infant Behavior and Development*. I. (Alternate Years.) 3 hr. Examination of theories of infancy and evaluation of current research literature in the areas of cognitive, perceptual, language, and social development. Prenatal and neonatal development will also be emphasized. Related social issues will be discussed.
 345. *Child Behavior and Development*. II. (Alternate Years.) 3 hr. Examination of the psychological literature on child behavior and developmental change in learning, cognition, language, social relations, and personality. Experimental research and theoretical explanations are emphasized, and implications for life-span development are discussed.
 346. *Adulthood and Aging*. I. (Alternate Years.) 3 hr. Comparative theories of life-span development; current issues in research on adulthood and aging, including personality and socialization, age norms, biological change in adulthood and aging.
 350. *Introduction to Behavioral Systems Analysis*. I. 3 hr. PR: Psych. 325 and 326 or consent. (Specially designed for graduate students in psychology.) An introduction to behavioral and systems concepts, methods, and models as they apply to human service management, administration, and evaluation.
 352. *Community Psychology*. I. (Alternate Years.) 3 hr. Psychological principles and research findings at the community level are applied to various types of intervention strategies. Manpower utilization, needs assessment, the community mental health movement, complex organization theory and behavioral systems analysis are included.
 360. *Behavior Pathology of Childhood*. I. 3 hr. Survey of types of adjustment problems of children, incidence and research and theory about etiology.
 364. *Child Behavior Modification*. II. 3 hr. Assessment, intervention, and evaluation strategies appropriate for childhood disorders and based on behavior modification principles derived from learning theory.
 379. *Introduction to Clinical Psychology*. I. 2 hr. Basic interviewing skills and current problems in the practice of clinical psychology.
 381. *Behavior Pathology*. II. 3 hr. PR: Psych. 281 or equiv. Advanced study of experimental research in psychopathology.
 397. *Master's Thesis*. I and II. 1-6 hr. PR: Consent.
 419. *Seminar Methodology*. I or II. 2 hr. per sem. PR: Consent. Current problems in statistics and research or instructional methods. (*Course will not be offered in 1981-82.*)
 420. *Reinforcement and Punishment*. II. (Alternate Years.) 3 hr. PR: Psych. 325, 326. Theories of response acquisition, maintenance, and suppression are examined in the context of recent experimental work with animal subjects.

421. *Behavior Theory and Philosophy*. I. (Alternate Years.) 3 hr. PR: Psych. 325, 326 or equiv. A critical review of theories, concepts, and methods of psychology. Mentalists, dialectic, and methodological behavioral perspectives are contrasted with the radical behavior perspective.
422. *Program Management*. I. (Alternate Years.) 3 hr. (Specially designed for doctoral students in psychology.) This course concerns the issues that will occur in managing a mental health program or unit that is part of a larger institute or community mental health center. (Course will not be offered in 1981-82.)
424. *Social Behavior*. I. (Alternate Years.) 3 hr. A learning approach to social psychology that will include both basic and applied problem areas. The area of social exchange such as cooperation, competition, and negotiation will be emphasized. (Course will not be offered in 1981-82.)
425. *History and Systems*. I. (Alternate Years.) 3 hr. The history of psychology is traced from European philosophy to the emergence of psychology in the United States. Emphasis is placed on the development of psychology in the United States leading to current theory and research. (Course will not be offered in 1981-82.)
426. *Stimulus Control and Memory*. II. (Alternate Years.) 3 hr. PR: Psych. 325 or consent. Contemporary review of basic research in stimulus control and memory emphasizing behavior theory. (Course will not be offered in 1981-82.)
427. *Behavior Analysis Practicum*. I, II, S. 1-6 hr. PR: Psych. 318 or consent. Supervised applied behavior analysis experience in an approved setting.
428. *Seminar in Behavior Analysis*. II. 3 hr. Current research and problem areas in the learning approach to behavior analysis. The topic of a given seminar may be either a basic research or an applied research problem area.
436. *Seminar in Learning and Cognition*. II. (Alternate Years.) 3 hr. (May be repeated for credit with consent.) Topical seminar on developmental aspects of learning and cognition. Specific topic examples include the role of imagery in learning and memory; theoretical analyses of age changes in discriminative learning and transfer.
437. *Practicum in Developmental Psychology*. I, II, S. 1-6 hr. PR: Consent. Provides experience in a wide range of applied settings. Sites will be chosen to accommodate exposure to the entire life-span from infancy through old age. Supervising responsibilities will be determined by the instructor-in-charge in the agency.
438. *Seminar: Early Development*. II. 3 hr. (May be repeated for credit with consent.) PR: Consent. Developmental processes during early childhood explored with emphasis on theoretical models, methodological and research issues, and experimental design. The specific topic will be dependent on the instructor.
439. *Seminar in Physiological Psychology*. I. 2 hr. Current research and problems in physiological psychology.
442. *Topical Seminar: Life-Span Development*. I. 3 hr. (May be repeated for credit with consent.) PR: Graduate standing or consent. Topical seminar exploring a particular period of the life-span, i.e., adolescence, or perspectives on the life-span, i.e., cross-cultural perspectives on the life cycle.
443. *Topical Seminar: Personality and Socialization*. II. 3 hr. (May be repeated for credit with consent.) Topical seminar on current issues in personality and socialization over the life-span or during selected periods of the life cycle.
451. *Clinical Service Management*. I. (Alternate Years.) 3 hr. PR: Psych. 350 or consent. (Specifically designed for doctoral students in psychology.) An overview of research and intervention strategies in administration and management of complex human service organizations from a behavioral psychology perspective.

453. *Systems Intervention and Consultation*. II. (Alternate Years.) 3 hr. PR: Psych. 350 or consent. (Specifically designed for doctoral students in psychology.) Consulting in complex organizations such as industry, community mental health centers, mental hospitals, facilities for the retarded, etc. Systems entry and maintenance are stressed as well as complex organizational theory and behavioral systems analysis.
456. *Program Evaluation in Clinical Services*. II. (Alternate Years.) 3 hr. (Specifically designed for doctoral students in psychology.) Examines the nature, method, and process of evaluative research, especially as it applies to social and behavioral treatment and service delivery programs.
457. *Systems Practicum in Clinical Services*. I, II, S. 1-6 hr. PR: Consent. (Specifically designed for doctoral students in psychology.) Supervised experience in the application of behavioral systems analysis and intervention in complex organizational settings.
458. *Seminar: Behavioral Systems Analysis*. I. (Alternate Years.) 3 hr. PR: Consent. (Specifically designed for doctoral students in psychology.) Current research and special topics related to systems analysis and behavior analysis in complex organizational settings.
464. *Family and Marital Therapy*. II. (Alternate Years.) 3 hr. PR: Clinical experience and/or relevant course practica; graduate standing; at least one upper-division course in behavior therapy or equivalent. Examines both theoretical and practical aspects of the assessment and treatment of family and marital difficulties.
467. *Child Clinical Practicum*. I, II, S. 1-6 hr. PR: Consent. Supervised field experience in various aspects of delivering psychological services directly or indirectly to children. Experience in assessment, treatment and program design, administration, and evaluation.
468. *Seminar in Child Clinical Psychology*. II. (Alternate Years.) 3 hr. Current issues and research related to a particular area of clinical psychology involving children.
470. *Behavioral Assessment I*. I. 3 hr. Conceptual and methodological bases for behavioral assessment; comparison of trait-oriented versus behavioral assessment; design and evaluation of measurement systems, particularly self-report, ratings by others, and direct observation, within the basic framework of generalizability theory.
471. *Behavioral Assessment II*. II. 3 hr. PR: Psych. 470, consent. Evaluation of clinically relevant behavior and environments by means of testing and other methods. Includes test selection, administration, and report writing.
477. † *Clinical Psychology Practicum*. I and II. 1-6 hr. per sem. PR: Consent. Supervised practice of psychological techniques in clinics or institutional settings. Experience in psychological testing, interviewing, report writing, case presentation, interpretation of tests and supportive counseling. (Primarily for students in master's program in clinical psychology.)
479. *Seminar: Clinical*. I or II. 2 hr. PR: Consent. Research and problems in clinical psychology.
480. *Clinical Neuropsychology*. II. 1-4 hr. Neuroanatomical foundations, neurobehavioral disorders, neuropsychological assessments, and psychopharmacological principles and practices relevant to clinical psychology.
481. *Psychophysiology*. II. (Alternate Years.) 3 hr. PR: 3 hr. of physiological psychology or consent. The current state of theory, methods, and findings concerning the association of physiological response systems and psychological states and processes, including biofeedback intervention.

482. *Adult Behavior Modification*. I. 3 hr. Reviews the roots and development of behavioral intervention with adult populations. Applied clinical intervention is stressed in concert with evaluation and research application.
490. *Teaching Practicum*. I and II. 1-3 hr. per sem. PR: Consent. Supervised practice in college teaching of psychology.
497. *Research*. I and II. 1-15 hr. per sem. PR: Consent.

PUBLIC ADMINISTRATION

Herman Mertins, Jr., *Chairperson of the Department*

302-B Woodburn Hall

Degree Offered: M.P.A.

Graduate Faculty: Members Byrd, Conaway, Mertins, and Williams. *Associate Members* Pops and Wolf.

The Department of Public Administration offers a public administration curriculum for graduate students seeking the degree of Master of Public Administration (M.P.A.) or a specialization in the field as part of another graduate degree program. This program provides a professional orientation to the primary facets of public management.

Master of Public Administration (M.P.A.)

The Master of Public Administration curriculum serves the needs of students from a variety of backgrounds who wish to pursue careers in public service. It directs particular attention to developing an understanding of the management function in the public context as well as preparation in utilizing advanced management techniques. The study program furnishes the student with opportunities to attain comprehensive understanding of governmental policymaking and policy execution. The processes of administration are reviewed in terms of their relationship with, and applicability to, the functioning of government at all levels.

The program is designed to supply an academic foundation for comprehension of the range of processes and management approaches employed in public administration. These include program planning, personnel administration, budgetary policy-making and policy execution, systems approaches, organizational dynamics, practically oriented research, and leadership. Particular stress is placed on those functions and issues that require the greatest degree of adaptation, innovation, and responsiveness on the part of the professional administrator.

The curriculum reflects the diversity of skills required by all levels of government. The range of needs is broad in scope; students apply from diverse backgrounds, including political science, other social sciences, physical sciences, humanities, and from positions in public service.

Curriculum. The M.P.A. degree requires the completion of 47 credit hours. This includes:

1. Public administration courses in core areas such as administrative organization and management, public personnel management, public budget formulation and execution, public financial management, quantitative analysis (Pol. S. 200), applied research, and operations research (I.E. 359),
2. Two semesters of colloquium (guest speakers and special presentations),
3. Intern experience, and
4. Selections from a wide range of specialized public administration courses and elective courses offered in other fields.

Most students take 23 hours of required courses and colloquium, 3-9 hours internship, and 15-21 hours from the specialized public administration and elective courses (depending on the type of internship and the amount of credit). These general requirements can be tailored to individual student needs with revisions agreed upon by both the student and adviser.

It will usually take the equivalent of one calendar year for full-time students to complete on-campus requirements. In addition, the off-campus internship will generally be one semester in length and may be taken after part of the course work is completed. For those individuals who have been in full-time public service positions, projects relating directly to that work experience can be designed for internship credit.

Tool Requirement. While tool skills are included in the required courses, it is strongly recommended that students take courses in accounting, statistics and computer science as part of their undergraduate program. Course work may also be taken at the graduate level in these subjects (200 and above) and counted as elective hours.

Admission Requirements. Candidates must meet the admission requirements of the Graduate School for graduation from an accredited college and grade-point average. Admission into the M.P.A. program is competitive with decisions based on:

1. Application for Admission to the Graduate School and transcripts (submitted to the Dean of Admissions and Records).
2. Three letters of evaluation (forms are available from Chairperson of the Department of Public Administration), Graduate Record Examination scores (both the aptitude test and an advanced test), a vita, any other information that would be supportive, and interviews, where possible. (These materials should be submitted to the Chairperson of the Department of Public Administration.)

In the case of practicing administrators, a record of accomplishment in administrative performance will be weighed heavily in combination with the criteria outlined above.

Students applying for First Semester or Summer admission should have all application materials submitted no later than March 15. Notification on admission status will take place around April 1. Students applying for the Second Semester should have all application materials completed by October 15; notification is given around November 1. Late applications for admission will be considered when all of the above requirements are met, assuming that openings in the program are available.

Application forms and information may be obtained by contacting the Chairperson of the Department of Public Administration.

Public Administration (Pub. A.)

242. *American Administrative Systems*. I. 3 hr. Analysis of the nature and processes of American public administration (political, legal, economic, and social conditions), including the role of the bureaucracy in a democracy. (Equiv. to Pol. S. 242.)
341. *Administrative Organization and Management*. I, II, S. 3 hr. Introduction to public administrative organization and such management functions as leadership, planning, coordination, communication, and decision-making.
343. *Public Personnel Administration*, I, II, S. 3 hr. Merit system concept, career staffing, classification and salary administration, selection, evaluation, manpower utilization, training, the rights and duties of employees, equal employment, and labor relations in the public sector.

345. *Public Administration and Policy Development*. I. 3 hr. Policy development examined in terms of values, process, specific policy cases, alternative "futures" analyses and policy science.
403. *Internship*. I, II, S. 3-9 hr. (Students may not enroll more than twice for a total of 9 hr.) PR: Consent; completion of at least one term of graduate study in public administration. A working internship in a government or public service related agency, designed to provide students with an opportunity to gain field experience, and to relate knowledge gained through course work situation. (S/U grading.)
404. *Public Service Internship Analysis*. I, II, S. 3 hr. PR: Completion of at least one term of graduate study in public administration and registration in Pub. A. 403. Designed for students enrolled in Pub. A. 403. Students undertake in-depth analysis of elements of their internship (policy matters, organizational questions, administrative dilemmas, etc.), and prepare a written report.
439. *Administration Justice*. II. 3 hr. Analysis of concepts of justice in public administration. The focus is upon conflict between systems of individual and social justice, personal ethics in government, and the control of administrative discretion.
440. *Readings and Research — Public Administration*. I, II, S. 1-3 hr. (Students may enroll more than once.) PR: Consent.
443. *Public Employee Labor Relations*. I, S. 3 hr. PR: Consent. Provides overview of theory, structures, and issues of public-sector labor relations; specific knowledge and training in processes and behaviors of contract negotiation and contract maintenance; and introduction to conflict management in non-unionized settings.
444. *Public Program Planning*. II. 3 hr. Focuses on planning as a determinant of system direction, operation, and performance. The course is designed both to survey and make various applications of program planning and systems concepts in public administration.
445. *Public Budget Formulation and Execution*. I, II, S. 3 hr. Emphasizes concepts of budgeting and budgetary applications at the federal, state, and local levels of government. The case method is utilized to cover objectives, performance criteria, output measures, and technical procedures.
447. *Applied Research in Public Administration*. I, II. 3 hr. PR: Pol. S. 200 and consent. The student will complete a major field research project. Each project includes research design, data collection and analysis, and comprehensive final report.
448. *Legal Environment of Public Administration*. I, II. 3 hr. PR: Consent. Explores the constitutional-legal basis of public administration; the legal profession and legal reasoning; provides training in legal research and advocacy; conveys knowledge of administrative legal processes and responsibilities of government administrators.
449. *Seminar in Public Administration*. II. 3 hr. PR: Consent. (Course will not be offered in 1981-82.)
450. *Administrative Behavior in Public Organizations*. II, S. 3 hr. PR: Consent. Introduces and familiarizes the student with the nature of individual and group behavior in public organizations and bureaucratic settings.
491. *Advanced Study*. I, II, S. 3 hr. PR: Consent. The course will focus on those subjects of most topical concern in public administration.
499. *Colloquium*. I, II, S. 1 hr. PR: Limited to M.P.A. students. A series of selected speakers and presentations on a wide range of topics related to public administration and public affairs. (S/U grading.)

READING

Lawrence G. Erickson, *Coordinator of the Reading Center*
506 Allen Hall

Degrees Offered: M.A., C.A.S., Ed.D.

Graduate Faculty: Members Erickson, Fairbanks, Hatcher, Heldfeldt, Ribovich, and Saltz.
Associate Members Hobbs and Smith.

Curriculum in Reading

All applicants must comply with the requirements of the Graduate School, College of Human Resources and Education, and the Reading Center.

Graduate students with successful teaching experience at the elementary, secondary, or college levels, or those who desire to enter these fields, may wish to increase their competence as teachers of reading, to keep informed of latest trends and developments, or to advance to positions of greater responsibility.

The Reading Center offers graduate programs leading to a Master of Arts degree in reading, the Certificate of Advanced Study in reading, and the Doctor of Education degree with emphasis in reading. Completion of these advanced programs may lead to a certification as a reading specialist or reading supervisor.

Course offerings provide opportunities to become familiar with the organization, implementation, and administration of developmental and remedial reading programs for students at the elementary, secondary, and college levels. Advanced students of superior academic and professional background have opportunities to participate in clinical work, to become involved in research, and to prepare for positions in public and private schools at elementary, secondary, and college levels, as well as related positions in industry and business.

Programs of graduate study for the Doctor of Education degree are worked out individually with each student. Course requirements depend upon previous academic background and experience and the position for which the student wishes to prepare. Practical training for teachers and specialists-in-training is provided by the Reading Clinic.

The University Reading Laboratory (URL) is a service for undergraduate students who seek help with reading and study skills. This program provides opportunities for experience in college-adult reading for the graduate students in reading who, as teaching assistants, are part of the URL staff. Practicum experiences may sometimes be available for other graduate students interested in this area.

Master of Arts (Reading)

Special Program Requirements

1. Students must complete 6 or more hours in reading within two years after admission (probationary or regular) or admission will be invalidated and the student will be required to reapply.

2. Program A — Completion of a minimum of 36 hours including the completion of a problem or thesis.

3. Program B — Completion of a minimum of 36 hours of course work.

4. Successful completion of a written final examination.

Course Requirements

(The course requirements in Program A and B lead to Reading Specialist Certification.)
(Electives should be decided in conference with adviser.)

A. Required Courses	Program	Hours	
		A	B
Rdng. 321		3	3
Rdng. 322		3	3
Rdng. 324		3	3
Rdng. 326		3	3
Rdng. 327		3	3
Rdng. 340		3	3
Rdng. 341		3	3
Rdng. 495		6	0
C&I 301 or 304 or 307		0	3
Ed. P. 330 or Rdng. 380/Measurement/Evaluation in Lang. Arts		3	3
Ed. P. 300 or 450 or 451 or Psych. 263 or 264 or 281		3	3
Sp. Ed. 250 or Psych. 282		3	3
		36	33
B. Electives		0	3
Total		36	36

Reading (Rdng.)

221. *Developmental Reading*. I, II. 3 hr. PR: Consent. Fundamentals of reading instruction. Emphasizes classroom organization and teaching techniques.
222. *Reading in the Content Areas*. I, II. 2 hr. Skills and strategies needed by content area teachers to reinforce the reading skills necessary for the effective learning of secondary students in the content areas.
240. *Corrective Language Arts Techniques*. I, II. 3 hr. PR: Rdng. 221, consent. Fundamentals of informal language arts diagnosis and corrective classroom language arts instruction. A practicum for the utilization of informal diagnosis and correction techniques is provided.
283. *Special Workshop in Reading*. I, II, S. 1-6 hr. For elementary and secondary students in preservice education programs, as well as for elementary and secondary teachers in inservice education.
321. *Reading Instruction in Elementary Schools*. I, II, S. 3 hr. Gives students who have little or no background in reading an opportunity to study the reading process and to learn how to apply effective techniques and methods at the elementary school level. Grades K-6.
322. *Reading Instruction in Secondary Schools*. I, II, S. 3 hr. The reading skills essential at the secondary level and how they may be developed in the various subject-matter areas.
323. *Reading and Early Childhood Education*. I, II, S. 3 hr. Development of a reading-language program for young children that includes consideration of: (1) the nature of the beginning reading process, and (2) the nature of children's cognitive, perceptual, linguistic, psychological, physical, and social growth.
324. *Foundations of Reading Instruction*. I, II, S. 3 hr. The physiological, psychological, sociological, and historical foundations underlying the development of reading proficiency. For majors in education, reading, counseling and guidance, special education, speech communication, and other areas requiring an understanding of the reading process.

325. *Survey of Major Problems in Reading*. II, S. 3 hr. PR: Rdng. 321 or 322 and 324. A research course in which each student will complete an individual problem in an area of special interest.
326. *Reading Leadership Skills*. I, II, S. 3 hr. PR: 18 hr. of M.A. requirements. Roles, responsibilities, and practices of reading specialists and administrators in organizing reading programs from early childhood through college.
327. *Developing Reading Interests*. I, II, S. 3 hr. Emphasis on methods and techniques for developing reading habits, interests, and tastes and on motivating individuals to read. Special attention is given to integrating the use of children's literature with creative oral and written language.
330. *Teaching the Language Arts*. II, S. 3 hr. The interrelationship of the different phases of the language arts. Special attention to organizing the language arts program, selecting materials and equipment, and understanding effective techniques and methods for teaching listening, oral language, written language, handwriting, and spelling.
331. *Selection and Evaluation of Reading Materials*. I, S. 3 hr. PR: Rdng. 321. Survey of critical reading skills, techniques, and procedures with emphasis on the selection of supplementary materials needed for effective developmental and remedial reading programs.
332. *Survey of Major Problems in the Language Arts*. II, S. 3 hr. PR: Rdng. 330 or consent. An advanced course covering major problems of the teacher or supervisor of language arts instruction. A research course in which the student completes an individual problem.
340. *Diagnostic And Prescriptive Reading Instruction*. I, II, S. 3 hr. PR: 6 hr. of Rdng. 321 or 322, or 324. Course designed to develop and implement theoretical concepts in the diagnosis and prescription of language problems. Emphasis on techniques utilized by classroom and special teachers of reading and language arts.
341. *Problems in Clinical Reading*. I, II, S. 3 hr. PR: Rdng. 340. Laboratory course in remedial reading. Major emphasis on tutoring remedial cases in the Reading Center.
342. *Reading Diagnosis and Prescription in Learning Disabilities*. I, II, S. 3 hr. PR: Consent. Basic course in diagnostic and prescriptive reading techniques and procedures for learning disability majors. Special emphasis on practicum experiences in administering and interpreting reading tests, as well as prescribing and administering remediation suggestions.
380. *Seminar*. I, II, S. 1-6 hr. PR: Consent. Seminar for master's degree students stressing special topics concerned with the education and sociological and psychological aspects of language arts instruction.
381. *Special Topics*. I, II, S. 1-6 hr. PR: Consent. Special topics or research in reading and language arts for master's degree students in reading.
385. *Practicum*. I, II, S. 1-12 hr. PR: Consent. Practicum type course for master's degree student teaching, and reading administration and supervision practicum experience can be pursued.
395. *Problem in Reading*. I, II, S. 3 hr. Research for master's degree in reading.
442. *Diagnosis of Reading Difficulties*. I, S. 3 hr. PR: Rdng. 340. Advanced instruction in diagnosis. Emphasis on use of standardization tests, informal tests, machines, and observation in determining reading difficulties.
443. *Correction of Reading Difficulties*. II, S. 3 hr. PR: Rdng. 442 or consent. Advanced instruction correcting reading difficulties. Emphasis on methods of teaching, use of

machines and commercial materials, constructing and using teacher-made exercises, and evaluating progress.

- 444. *Advanced Clinical Reading*. I, II, S. 3 hr. PR: Rdng. 341. Laboratory course in remedial reading. Emphasis on diagnosis and treatment of reading difficulties.
- 480. *Seminar*. I, II, S. 1-6 hr. PR: Consent. The interrelationships among the language arts: mental, physical, and psychological deterrents to language arts; and similar topics.
- 481. *Special Topics*. I, II, S. 1-6 hr. PR: Admission to doctoral program in reading and consent. Advanced seminar. Weaknesses and strengths in current reading programs, needed research in reading, and suggestions for improving reading instruction at elementary, secondary, and college levels.
- 485. *Practicum*. I, II, S. 1-12 hr. PR: Consent. Practical application of reading theory to organizing and conducting developmental and remedial reading programs.
- 497. *Research*. I, II, S. 1-15 hr. Research for doctoral degree in reading.

RECREATION AND PARKS MANAGEMENT

Jack E. Coster, Chairperson, Division of Forestry
322-A Percival Hall

Degree Offered: M.S.

Graduate Faculty: Member Coster. Associate Members E. C. Bammel, L. L. Bammel, Boteler, Hummel, Hutchison, and Wylie.

Master of Science (M.S.)

The Division of Forestry of the College of Agriculture and Forestry offers programs leading to the degree of Master of Science for students who wish to major in a forestry-related field (e.g., recreation, wildlife management, wood industries) but do not wish to pursue the specific Master of Science in Forestry route. Applicants should have a bachelor's degree, with good academic performance and an appropriate background in the subject matter of the chosen field. With the exception of those majoring in recreation, candidates must complete 30 credits of approved study, 6 of which shall constitute a thesis. Students majoring in recreation have the option of earning the degree on the basis of 30 hours with a thesis or 36 hours without a thesis. These programs ordinarily require two years of residence.

Recreation and Parks (Rc. & Pk.)

- 201. *Wildland Search and Rescue Techniques*. I. 2 hr. PR: Consent. Acquaints future forest, park, and recreation area professionals with the safe methods, practices, and procedures of search and rescue of lost and/or injured persons. Some weekend field trips required.
- 202. *Recreation Internship*. I. 3 hr. PR: Rc. & Pk. 43, 44, 265; recreation major or consent. A supervised, full-time recreation leadership responsibility for a minimum of 8 weeks. Position approval in advance. Comprehensive written analysis prepared following internship field experience.
- 216. *Philosophy of Recreation*. II. 3 hr. PR: Consent. Interpretation of recreation as a basic part of the living process; importance to individual community and national welfare; social and economic significance.
- 224. *Outdoor Recreation in Our Modern Society*. II. 3 hr. PR: For persons in recreation, park, outdoor education and conservation, or consent. Interpretation as to what

outdoor recreation is, what people do, where they go, how this affects our economic, social and cultural life, and significant trends.

233. *Wildland Recreation Administration*. I. 3 hr. PR: Recreation junior standing or consent. Introduction to administration and management problems associated with providing recreation in wildland areas.
235. *Administration of Urban and Regional Recreation Services*. I. 3 hr. PR: Recreation major, Rc. & Pk. 43, 44, and 265 or consent. Administration of recreation and parks agencies, including legal foundations and responsibilities, organizational structures, personnel, finance, and services.
241. *Recreational Services for Special Populations*. I. 3 hr. PR: Consent. Introductory analysis of current therapeutics recreation services; attentiveness to the need for broadening recreation and park services to include members of special populations; familiarization with the planning consideration for the conduct of such services.
242. *Historical and Cultural Interpretation*. II. 3 hr. PR: Recreation major or consent. Methods of locating source materials for reconstructing the historical, cultural, and physical aspects of an area for an interpretive center; preparing brochures, displays, and nature trails to facilitate interpretive activities.
248. *Environmental Concerns in Outdoor Recreation*. I. 3 hr. PR: Consent. Understanding and interpreting environmental concerns within the context of outdoor recreation.
251. *Recreation Leadership*. I. 3 hr. PR: Recreation major or consent. Leadership, its application to recreation, and analysis of techniques. Examination of social group work method and its application, particularly in national youth organizations.
263. *Program Planning*. II. 3 hr. PR: Recreation major or consent. Fundamentals for general program planning; considers needs, facilities, age groups, local customs, climatic factors, etc. Planning involved in playgrounds, indoor centers, playfields, parks, hospitals, voluntary agencies, industry, and camps.
265. *Functional Planning of Recreation and Park Facilities*. II. 3 hr. PR: Recreation major or consent. Lecture and workshop. Problems and principles governing planning for functional and effective use of recreation facilities. Emphasis on playgrounds, playfields, indoor centers, parks, camps, and swimming pools.
271. *Administration of Camping Services*. II. 3 hr. PR: Recreation major or consent; Rc. & Pk. 40 or equiv. Principles involved in modern camping programs, and organization and administration of camps.
272. *Professional Synthesis*. II. 3 hr. PR: Recreation major or consent; senior standing, last semester of professional education; 16 hr. professional courses in recreation and parks management. A "capstone" course which requires the student to synthesize professional training into analysis and solution of a special problem in the student's option of Recreation and Parks Management.
408. *Practicum in Recreation*. I, II. 4 hr. PR: Rc. & Pk. 472, PESE 396, 397. Program planning, curriculum development, and job functions in recreation.
415. *Leisure and Recreation*. I. 3 hr. PR: Consent. Study of leisure as a social phenomenon and its implications for recreation.
421. *Human Interest Areas in Recreation Planning*. I. 3 hr. PR: Rc. & Pk. 316 or 20 hr. in Education or equiv. Exploration of human interest areas which are sources of recreation program content; their adaptation to school and municipal recreation program planning. (Offered in Fall of even years.)
462. *Community Recreation*. I. 3 hr. PR: Rc. & Pk. 316 or consent. Study of problems related to providing adequate recreation services for a community. Standards and quality of recreation service; methods of measuring existing services and their

coordination; community organization procedures. For leaders in voluntary agencies, schools, churches, and municipal recreation organizations. (*Offered in Fall of odd years.*)

472. *Seminar in Recreation*. I, II. 4 hr. PR: Rc. & Pk. 316. Overview and critical analysis of literature and research in recreation.

REHABILITATION COUNSELING

Jeffrey K. Messing, *Chairperson of the Department*
502 Allen Hall

Degree Offered: M.S., Ed.D.

Graduate Faculty: Members Blaskovics, L. S. Cormier, W. H. Cormier, DeLo, Jacobs, Majumder, Marinelli, Masson, Messing, Srebalus, Tunick, and Yura. Associate Members Greever and Moriarty.

The Department of Counseling and Guidance and Rehabilitation and Counseling of the College of Human Resources and Education offers a curriculum at the master's degree level. All students enroll for a general counseling core during their first semester and then select an area of emphasis for the balance of their graduate studies.

General Requirements for Admission

All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Counseling and Guidance and Rehabilitation Counseling.

Students are encouraged to pursue as much of their program as possible on a full-time basis.

Core Requirements for Rehabilitation Counseling

All students will be expected to take the following core courses:

C&G 301 — Fundamentals of Counseling

C&G 303 — Basic Course in Guidance

C&G 305 — Theory and Practice of Human Appraisal

C&G 306 — Counseling Theory and Techniques

Rehabilitation Counseling (M.S.)

This is a professional counseling specialty that provides vocational and personal counseling to physically handicapped clients, persons with learning difficulties, and those who are seeking readjustment from psychiatric problems. Counselors work for both public and private rehabilitation agencies, centers, and workshops.

The degree requirements include completion of the core courses, required rehabilitation counseling courses, and a 10-12 hour supervised clinical practice placement (internship) under faculty direction in a rehabilitation setting. The program requires a minimum of 42 semester hours with a 3.0 grade-point average. In most cases, the total program will range between 42-48 semester hours. In addition to completing all course work and the internship satisfactorily, a candidate must demonstrate the ability to assume the responsibility required of a professional counselor and the personal characteristics essential to effective working relationships with others.

Please contact the department for a listing of the additional required courses in this area.

Students may take the professional certification examination to obtain national certification as a rehabilitation counselor.

Rehabilitation Counseling (Ed.D.)

Doctoral study in Rehabilitation Counseling includes courses in the following areas: measurement and evaluation, consultation and teaching, and counseling practice. The program typically includes course work hours in excess of the minimum limits established in the College of Human Resources and Education requirements for the Ed.D. degree.

Entrance Requirements

1. Admission to the WVU Graduate School.
2. Completion of a master's degree program in Rehabilitation Counseling, or equivalent. The equivalency should be comparable to the WVU master's degree program.
3. No minimum grade-point average has been established for admission to the program, except that established by the Graduate School. It is recommended, however, that the student's graduate grade-point average be in the vicinity of 3.5.
4. Complete the aptitude section of the Graduate Record Examination and have the scores of those tests placed on file in the department. No cut-off score has been established, but most students admitted to the program have a total aptitude score of around 1,000.
5. A personal interview with the faculty is necessary. If this is not possible, the department reserves the right to have the applicant be interviewed by a professor in another institution who can make recommendations regarding the student's qualifications for doctoral study.
6. At least three references should be submitted to the department and should pertain to the individual's competency in counseling, measurement, statistics, research, etc. The references also should contain information regarding the individual's personal characteristics particularly as they relate to the completion of a doctoral program.
7. The application form for a doctoral program should be completed.
8. Upon the completion of the above steps, the materials will be reviewed by the faculty which is usually conducted during the months of January and February. Announcements regarding admission are made on or before March 15. Materials received after January 15 will not be reviewed until the following year. All students not enrolling for courses during the year following admission must reapply before taking course work.

Counseling and Guidance (C&G)

301. *Fundamentals of Counseling*. I, II. S. 3 hr. PR: Consent. Development and application of basic counseling skills including interviewing, clinical observation, and a general orientation to counseling settings. Evaluation will be based on strengths and deficits in intra and interpersonal skills and on demonstration of counseling skills in checkout situations. In setting laboratory experience required.

303. *Basic Course in Guidance*. I, II, S. 3 hr. An overview of the counseling profession, treating current practices and issues.
305. *Theory and Practice of Human Appraisal*. I, II, S. 3 hr. An overview of standardized evaluation methods commonly utilized in educational and rehabilitation settings. Experience is provided in selection, administration, and interpretation of selected instruments.
306. *Counseling Theory and Technique*. II, S. 3 hr. PR: C&G 303 and consent. A study of counseling approaches commonly used in public schools, colleges, and rehabilitation agencies. Application of theory emphasized.

Rehabilitation Counseling (Rehab.)

300. *Introduction to Rehabilitation Services*. I. 2 hr. PR: Consent. Introduction to comprehensive rehabilitation, its history and development as a philosophy, process, and professional area. Rehabilitation counselors and other rehabilitation disciplines in various settings. Counseling and other services involved in rehabilitation.
310. *Medical Aspects of Rehabilitation*. II. 3 hr. PR: Consent. An overview of medical aspects and implications of disability for the handicapped person in the rehabilitation process. Studies of the more common severe disabilities and their remediation also will be included.
312. *Psychological Aspects of Disability*. II, S. 1-3 hr. PR: Graduate standing and consent. The impact of disability considering cultural, interpersonal and intrapersonal factors. Methods of assisting persons to adjust to problems of disability. (Course will not be offered in Summer, 1981-82.)
314. *Special Problems in Rehabilitation*. I, II. 1-3 hr. PR: Graduate standing and consent. Rehabilitation theory and techniques in problems such as blindness, epilepsy, and mental retardation. Concentrated study in special institutes.
320. *Vocational Development and Occupational Choices*. II. 3 hr. PR: Consent and graduate standing in social sciences or education. Principles and methods involved in the vocational counseling and placement of disabled persons. The use of occupational and educational information. Theories of career development, occupational analysis, and work evaluation in rehabilitation.
374. *Field Work in Rehabilitation*. I, II, S. 1-6 hr. PR: Consent. Supervised field work experience in rehabilitation settings to provide rehabilitation counseling students with a more adequate orientation to their profession.
462. *Clinical Conference in Vocational Rehabilitation*. II. 3 hr. PR: Rehab. 300, graduate standing, and consent. Exploration and evaluation of current methods of service delivery to vocational rehabilitation clients. Analysis and integration of service systems and the needs of the disabled client.
472. *Counseling Practicum*. I, II, S. 1-4 hr. PR: Graduate standing, liability insurance, and consent. Supervised experience in the application of counseling techniques in the rehabilitation process. Demonstration of high professional standards, counseling skills, and personal characteristics, appropriate to the counseling relationship are essential.
475. *Clinical Practice*. I, II, S. 1-2 hr. PR: Liability insurance, consent, following at least one academic semester in classroom. Clinical practice (internship) in selected agencies, rehabilitation centers, clinics, or hospitals conducting an organized program of services for the physically, mentally, emotionally, or socially handicapped. Practice will be under direct supervision of faculty and agency personnel.
480. *Seminar*. I, II, S. 1-12 hr. PR: Consent. Administration of programmatic research; legal and ethical issues in research and service programs, etc.

481. *Special Topics*. I, II, S. 1-6 hr. PR: Consent. Contemporary issues in the behavioral sciences and rehabilitation.
482. *Workshop in Rehabilitation*. I, II, S. 1-12 hr. PR: Consent. Supervision in the counseling process; vocational evaluation in rehabilitation; utilization of rehabilitation research; contemporary issues in rehabilitation.
491. *Directed Study and Research*. I, II. 1-6 hr. PR: Consent. Readings and/or independent research in related topic.

REPRODUCTIVE PHYSIOLOGY

E. Keith Inskip, *Chairperson of the Interdisciplinary Faculty*

G-016 Agricultural Sciences Building

Degrees Offered: M.S., Ph.D.

Graduate Faculty: Members Anderson, R. L. Butcher, Collins, Dailey, Horvath, Inskip, Kidder, P. E. Lewis, McCafferty, Mawhinney, Moran, Nath, Peterson, J. S. Thomas, and J. A. Welch. Associate Member J. E. Jones.

The graduate program in Reproductive Physiology, leading to the M.S. and Ph.D. degrees, is interdisciplinary, with faculty located in the Departments of Anatomy, Animal and Veterinary Sciences, Biology, Internal Medicine, Obstetrics and Gynecology. Pharmacology and Toxicology, Plant and Soil Sciences, and Surgery. Requirements for admission include at least a 2.75 grade-point average (4.0 system) and completion of the following prerequisites with a grade of C or better in each: calculus, genetics, organic chemistry, physics, and vertebrate embryology. It is recommended that applicants complete both the aptitude and the advanced tests of the Graduate Record Examination. Foreign languages are not required for a degree in reproductive physiology.

Research Areas: Function and regression of the corpus luteum, aging of the oocyte in abnormalities of development, control of postpartum reproductive performance, metabolism and steroid receptors of male sex accessory tissue, environmental factors in reproduction, control of steroidogenesis, control of estrus and ovulation, use of artificial insemination, behavioral aspects of reproduction, endocrine function of vasoactive polypeptides, and role of prostaglandins in reproduction.

Research can involve farm animals, laboratory species, and human beings. The program draws on courses offered in various departments and should include work in endocrinology, advanced reproductive physiology, biochemistry, physiology, statistics, and developmental embryology.

SAFETY STUDIES

Daniel E. Della-Giustina, *Acting Chairperson, Department of Safety Studies*

273 Coliseum

Degrees Offered: M.S., C.A.S., Ed.D. (See Part 3 for doctoral information.)

Graduate Faculty: Members Della-Giustina and Marcum. Associate Members Shaffron and Sorine

Master of Science — Safety Studies

Concentration in Safety Studies at the master's degree and post-masters' level provides opportunity for individuals to elect courses and related ex-

periences aimed at developing competencies needed by driver safety educators, occupational safety managers, or school safety coordinators. Baccalaureate degree programs from which students are usually admitted include business management, engineering, technology education, physical education, physical science, psychology, sociology and anthropology, or safety, provided that a 2.5 grade-point average has been achieved. Otherwise, admission must be of provisional status which requires the student to earn a 3.0 average on the first 12 semester hours of residence work and also pass qualifying examinations in order to continue.

Regulations of the Graduate School govern the general requirements of the master of science degree. Additionally, however, the candidate must complete a minimum of 36 semester credit hours including an approved research experience in safety to qualify as a degree recipient. A grade-point average of 3.0 will be required for graduation.

Course work must be planned in consultation with the adviser and approval must be obtained from the adviser before enrollment in courses. Six semester hours of course work may be devoted to directed electives from one of the student's undergraduate major or minor fields or from a field allied to safety. Students are encouraged to complete the Aptitude Test of the Graduate Record Examination within the first 18 semester hours after matriculation.

A student is accepted as an advanced candidate for the degree providing course work and requirements previously mentioned are of a satisfactory nature as judged by the graduate committee of the department. During the final term or semester of study, each student will be required to pass successfully an examination dealing with the core subject matter and specialization emphasis.

Safety Studies (Saf. S.)

231. *Safety in Motor Transportation Services. II.* 3 hr. PR: Saf. S. 131 or consent. Safety elements of automotive transportation equipment. Design, operation, planning and control plus effects of legislation. The school motor fleet is highlighted.
232. *Safety Education Principles and Content. I.* 3 hr. PR: Saf. S. 131 or consent. Study and analysis of content areas usually recommended for instructional programs within the field of safety, with emphasis on structured learning experiences.
254. *Teaching Driver and Highway Safety. S.* 3 hr. PR: Saf. S. 151 or equiv. and valid driver license. Teaching and coordinating driver and highway safety education in schools. Arranged laboratory assures practice in providing behind-the-wheel instruction to beginning drivers.
256. *Driver and Safety Instructional Innovations. II, S.* 3 hr. PR or Conc.: Saf. S. 151 and 254. Multimedia, multivehicle, simulation, and other innovations for classroom and laboratory instruction applied to driver and safety education as revealed by research and current literature.
291. *Special Topics. I, II, S.* 2-6 hr. PR: Consent. Consideration of persistent issues and changing problems in the safety field. Seminar emphasis extends considerable attention to safety interests of participating class members.
300. *Contemporary Safety Beliefs and Foundations. II, S.* 3 hr. Philosophies of the safety movement as expressed by leaders in the field are related to accident causation, accident prevention, and research implications.
310. *Controlling Environmental and Personnel Hazards. I or II, S.* 3 hr. PR: Saf. S. 300 or consent. Investigation of hazard control principles relating to environmental facilities and equipment including control procedures recommended by authorities

from the fields of engineering, medicine, and public health as well as from the field of safety.

311. *Accident Countermeasures for Human Factors*. I or II, S. 3 hr. PR: Saf. S. 300 or consent. Investigation of concepts dealing with human behavior as related to accident experience in major categories with consideration of psychological, sociological, and health implications.
330. *Health Hazard Loss Control Management*. I, II. 3 hr. PR: Consent. Safety manager utilization of public health, legislative, industrial hygiene, engineering, medical, nursing, and education resources designed for identifying, controlling, and minimizing occupational health hazards and related losses.
333. *Disaster Preparedness and Emergency Systems*. I or II, S. 3 hr. PR: Saf. S. 300 or consent. Major elements involved in disasters and emergencies, preparedness planning, systems utilization, and attention to essential human services, with emphasis on community action.
334. *Establishing and Managing Fire Services*. I or II, S. 3 hr. PR: Saf. S. 300 or consent. Analysis of fire services usually provided under safety manager jurisdiction, with special attention to legal bases, organizational structure, services rendered, training needs, and management techniques.
335. *Safety Legislation and Compliance Operations*. I, S. 3 hr. PR: Saf. S. 300 or consent. Comprehensive study and analysis of federal and state legislation which mandates compliance with certain safety conditions and practices related to work performed in occupational and comparable settings.
336. *Safety and Loss Control Management*. I, S. 3 hr. PR: Saf. S. 300 or consent. Management guidelines, functional standards, and operational features applicable to safety and loss control programs designed for business, governmental, industrial, and educational enterprises.
339. *Security Management Practices and Problems*. I or II, S. 3 hr. PR: Saf. S. 300 or consent. Safety manager responsibilities for security of persons and property including organizational patterns, personnel competencies expected, surveillance and monitoring methods, and occupational problems among security personnel.
418. *Safety, Measurement, Evaluation, and Research*. II, S. 3 hr. PR: Saf. S. 300. Analysis of evaluative data and statistical procedures applicable to the safety field plus investigation of nature and purposes of research dealing with safety and accident prevention with emphasis on human and environmental factors.
452. *Manpower Development for Safety Responsibilities*. II. 3 hr. PR: Graduate standing in safety studies and consent. Safety manpower positions, needs and problems in relation to efforts by business, industrial, governmental and educational agencies to provide sufficiently effective professional and sub-professional preparation of safety practitioners.
457. *Planning and Coordinating Safety Programs*. I. 3 hr. PR: Advanced graduate standing in safety studies or consent. Organizational structure, planning resources and techniques, and coordination functions involving safety programs in business, industry, government, and education.
459. *Directed Study*. I, II, S. 1-6 hr. PR: Doctoral level standing and consent. Analysis of research designs and procedures for compilation, organization, treatment, and interpretation of data for safety research projects. (Required of all candidates for doctoral degrees in safety studies.)
472. *Practicum*. I, II, S. 1-6 hr. PR: Graduate standing in safety studies and consent. Individual and/or group experiences in development, implementation, and participation in special projects involving safety education, safety services, and environmental safety in schools, colleges, or communities.

- 490. *Teaching Practicum*. I, II, 3-15 hr.
- 491. *Advanced Study*. I, II, S. 1-16 hr.
- 492-495. *Special Seminars*. I, II, S. 1-6 hr. each.
- 496. *Graduate Seminar*. I, II, S. 1-3 hr.
- 497. *Research*. I, II, S. 1-15 hr.
- 498. *Thesis*. I, II, S. 1-15 hr.
- 499. *Colloquium*. I, II, S. 1-6 hr.

SECONDARY EDUCATION

Paul R. McGhee, *Chairperson of the Department of Curriculum and Instruction*
602 Allen Hall

Degrees Offered: M.A., Ed.D.

Graduate Faculty: Members Bower, Carline, Carlton, Couch, DeVore, Douglas, Elkins, England, Erickson, Fairbanks, Fehl, Hatcher, Helfeldt, Holtan, Horacek, Iannone, Kelly, Kurucz, Lawrence, Love, O. C. McGhee, P. R. McGhee, Marcum, Moxley, Murphy, Murray, Obenauf, Parker, Phillips, Plants, Redick, Ribovich, Saltz, Sears, D. W. Sunal, Wales, Yeazell, and Yost. Associate Members Deay, DePue, Eisele, Hobbs, McCrory, Marsicano, Pytlik, Smith, Solomon, C. S. Sunal, Venable, and Wilhelm.

The Department of Curriculum and Instruction of the College of Human Resources, and Education offers a Master of Arts program for persons who teach or work in teaching related situations with adolescents and adults. The purpose of the program is to provide academic experiences that enhance teaching skills, curriculum development skills, and knowledge of a teaching specialization. The program provides the opportunity to specialize in working with students in junior (middle) and high schools and with adults in post-secondary settings. Electives are used to provide a solid basis in a subject area that the student has or will teach. With adviser approval, electives may also be used to enhance students' personal goals. While teacher certification is not a part of the master's program, through careful planning, students may be able to complete some courses required for certification while working on a graduate degree.

Master of Arts in Secondary Education*

All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Curriculum and Instruction.

I.	Graduate Courses in Education	Program	Hours		
			A ¹	B ²	C ³
	C&I 304		3	3	3
	Ed. F. 320 or 340		3	3	3
	Approved course in Curriculum/Instruction				
	in student's content field ⁴		3	3	3
	Approved course in General Teaching Strategies				
	or General Curriculum Development ⁵		3	3	3
	Ed. P. 320		3	3	0
	C&I 391		0	3	0
	C&I 497		6	0	0
	Approved Education Electives ⁴		0	3	6-12
II.	Approved Graduate Courses Outside of Education ⁴		9	9	12-18
			30	30	36

¹Thesis required.

²Problem required.

³36-semester hours program for classroom teacher.

⁴Adviser will provide lists of courses which may be selected.

⁵Usually courses in the student's content speciality.

*Students who plan to teach at the college level, who wish to study the impact of technology on people, society, and the environment, or who wish to prepare for a career as Librarian-Media Specialist, may pursue a concentration of course work emphasizing those areas.

Emphasis in Higher Education Curriculum and Teaching

I.	Graduate Courses in Education		Hours
	Required Courses in Education	12	18-21
	Ed. F. 320 or Ed. F. 340	3	
	C&I 307	3	
	C&I 380 (Teaching Strategies)	3	
	Ed. P. 300	3	
II.	Approved Education Electives	6-9	
		18-21	
III.	Graduate Courses in an Academic Area	15-18	
	Total	36	

Curriculum for Librarian-Media Specialist

A combination of undergraduate courses and courses in the graduate program is necessary to meet certification requirements.

Master of Arts in Education		Hours
I.	Graduate Courses in Education	12
	A. Required Courses in Education	9
	Ed. P. 260	
	C&I 304	
	Ed. F. 320 or Ed. F. 340	
	B. Approved Electives	3

Emphasis in Technology Education

	Option	A	B	C	D
I. Core Courses					Hours
(All graduate programs designed by student and adviser to meet student's specific needs.)					
Ed. P. 320 — Introduction to Research	3	3	3	3	
Ed. P. 330 — Advanced Educational Measurement	3	3	3	3	
and					and
T.E. 383 — Interdisciplinary Seminar	3	3	3	3	
T.E. 400 — Technology: Its History and Development	3	3	3	3	
T.E. 404 — Readings in Technology and Culture	3	3	3	3	
T.E. 498 — Thesis	0	0	0	0	6
and					and
T.E. 300 — Contemporary Problems in Transportation	3	0	0	0	3
T.E. 301 — Technical Development in Transportation	3	0	0	0	3
or					or
T.E. 310 — Contemporary Problems in Communication	0	3	0	0	3
T.E. 311 — Technical Development in Communication	0	3	0	0	3
or					or
T.E. 320 — Contemporary Problems in Production	0	0	3	3	3
T.E. 321 — Technical Development in Production	0	0	3	3	3
Total	21	21	21	21	27
II. Electives	15	15	15	15	9
Total	36	36	36	36	36

Electives are to be selected from University offerings and they must contribute to program objectives. Prior approval of the adviser is required.

Option A — Transportation Systems Concentration.

Option B — Communication Systems Concentration.

Option C — Production Systems Concentration.

Option D — One of the Above and Thesis.

Curriculum and Instruction (C&I)

205. *The Junior High School*. I, II, S. 2 hr. PR: Consent. Developing philosophy, program, and practices of the junior high school.
224. *Approaches to Teaching Language*. II. 2 hr. PR: Lingu. 1 and Engl. 111. Designed for prospective teachers of English and language arts. Focus is upon planning and implementing methods of teaching English as a language. Materials and resources appropriate to public school instruction are analyzed and utilized.
225. *Approaches to Teaching Literature*. II. 2 hr. PR: Junior standing. Designed for prospective teachers of English and language arts. Course focuses upon methodologies for teaching literature in public schools. Workshop format will provide opportunities for peer teaching activities as students apply methods of teaching literature.
267. *The Music Education Program*. S. 3 hr. PR: Consent. Organization and administration of the complete music education program for grades 1-12.
278. *Vocational Home Economics in Secondary Schools*. I. 3 hr. PR: Ed. P. 106; 25 hr. in family resources.
280. *Special Problems and Workshops*. I, II, S. 1-4 hr. PR: 14 hr. in education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 semester hours may be applied toward the master's degree.

287. *Advanced Clinical Experience*. I, II, S. 1-6 hr. PR: Consent. Clinical experience in teaching-learning situations at any level.
304. *The Secondary-School Curriculum*. I, II, S. 3 hr. PR: High-school teaching experience, or consent. Emphasizes socioeconomic and cultural influences on the curriculum; principles of curriculum development; curriculum building in the various teaching fields; techniques of experimentation and evaluation; and practice in curriculum building with special emphasis on unit construction.
306. *Curriculum for Middle Childhood*. I, S. 3 hr. Survey course which includes: historical, social, and cultural influences on the curriculum; the learner characteristics; curriculum and instructional organization and their relationship to facilities available; evaluation and implementation of middle childhood curriculum.
307. *Curriculum Development*. I, II, S. 3 hr. PR: C&I 301 or C&I 304 or C&I 312 and Ed.F. 320 or consent. Basic foundation in the concepts underlying the school curriculum in American society.
308. *Introduction to Alternative Learning Environments*. I. (Alternate Years.) 3 hr. This course will provide opportunities for educators to explore and analyze the trends and issues in alternative learning environments in public education.
309. *Experiences in Alternative Learning Environments*. S. (Alternate Years.) 6 hr. PR: C&I 308, Ed. F. 320, consent. This course helps teachers to learn and practice the skills that are needed to be an effective teacher in an alternative teaching environment.
323. *Contemporary Issues in English Education*. I. 3 hr. PR: Graduate standing. Provides the student with a knowledge of several contemporary issues in English teaching which have immediate and long-range ramifications for secondary-school English instruction. 1-hr. lec., 2-hr. seminar.
324. *Advanced Methods in English Education*. II. 3 hr. PR: Graduate standing. (For classroom teachers of English.) Will involve an analysis of recent trends and innovations in methodology. Readings and discussions will lead to the development of instructional strategies and units for secondary English classrooms. 1-hr. lect., 1-hr. lab., 1-hr. seminar.
330. *Mathematics in the Elementary School*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education or consent. Materials and methods of instruction for modern mathematics programs.
333. *Corrective Techniques in Mathematics Education*. I, S. 3 hr. PR: Consent. Materials and methods used in diagnosis and remediation of learning difficulties in mathematics.
334. *Mathematics in the Secondary School*. I, S. 3 hr. PR: Consent. Patterns of mathematics curriculum in the secondary school; practices in teaching mathematics; preparation, selection and use of instructional materials.
337. *Mathematics in the Junior High School and Middle School*. II. 3 hr. PR: 6 hr. college mathematics or consent. Study of teaching of mathematics in the junior high school and/or middle school; application of mathematics content to teaching; instructional techniques and materials.
340. *Science in the Elementary School*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Analysis of methods, curriculum patterns, and trends in elementary school science. Understanding and development of scientific attitudes appropriate at elementary school level.
350. *Social Studies in the Elementary School*. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Comprehensive consideration of objectives, content, methods, including unit procedures; materials including objects,

models, exhibits, and museum items, as well as textbooks, collateral reading, maps, and graphs; means of evaluating social growth and development.

354. *Social Studies in the Secondary School*. S. 3 hr. PR: Consent. Nature and function of social studies in the secondary school; utilization of community, state, national, and world resources in teaching; selection of content for teaching purposes; curriculum construction with emphasis on resource and teaching units.
357. *Principles of Economic Education*. S. 3 hr. Workshop for principals, teachers, and supervisors with emphasis on the economic structure of our society and methods of integrating economics into the school program. (Sponsored jointly by College of Human Resources and Education and College of Business and Economics.)
359. *Classroom Simulation Techniques*. II, S. (Alternate Years.) 3 hr. To provide experience in the use of learning games and simulations as an instructional technique and the opportunity to develop — under supervision — simulated activities and games to be used in a variety of learning environments.
363. *Teaching Young and Adult Farmer Classes*. I, S. 2 hr. PR: Ed. P. 106. Participation in conducting young and adult farmer classes and school-community food preservation centers; organization, course of study, and methods of teaching and supervision, and young farmers' association.
364. *Organizing and Directing Supervised Farming Programs*. II, S. 2 hr. PR: Consent. Planning programs of supervised farming, supervising and evaluating such programs for all-day students, young farmers, and adult farmers.
373. *Professional Development*. I, II, S. 1-6 hr. (May be repeated.) PR: Department approval. Specially designed experiences for those interested in advancing professional skills in a particular specialty. Not for degree credit in programs in the College of Human Resources and Education. (Graded as S/U.)
377. *Children's Television: Problems and Potentials*. S. 4 hr. PR: Consent. Provides parents and teachers with strategies for monitoring, evaluating, and directing television viewing habits of youth; pertinent research studies, school and community action programs, and home and school education programs are discussed and practiced.
380. *Special Topics*. I, II, S. 1-6 hr. PR: Consent.
383. *Seminar*. I, II, S. 1-6 hr. PR: Consent.
385. *Supervision of Student Teachers*. I, II, S. 3 hr. PR: Consent. For persons working or intending to work with education students in field experiences. Course focuses on the development and application of supervisory skills involved in effective guidance of student teachers and education students.
386. *Teaching Strategies for Middle Childhood*. II, S. 3 hr. Surveys instructional strategies appropriate for facilitating preadolescent learning. Includes the role of the teacher, how the teacher uses resources within and outside the classroom as they relate to instruction of the learner age 10-14 years.
391. *Problem in Education*. I, II, S. 3 hr. Research for master's degree in education, option B.
395. *Practicum*. I, II, S. 1-12 hr. per sem. or session — aggregating not more than 12 hr. PR: 9 graduate hr. in education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences or problems and projects in education.
407. *Instructional Models of Teaching*. II. 3 hr. PR: Ed. F. 320 or consent. Concepts and processes involved in teaching and their relationship to the development of teacher education programs.

408. *Contemporary Determinants of Curriculum*. II, S. 3 hr. PR: C&I 307 and Ed. F. 340 or consent. Contemporary determinants of curriculum development.
409. *Curriculum Theories*. I, II, S. 3 hr. PR: C&I 408 or consent. Theories underlying curriculum from the past to the present and projected to the future.
438. *Survey of Major Issues in Mathematics Education*. II, S. 3 hr. PR: Consent. Individual and group research on selected topics in mathematics education.
457. *Social Studies Curriculum Development, K-12*. I. 3 hr. PR: C&I 301 or 304 and C&I 350 or 354. Stresses the application of principles and procedures pertinent to the development of social studies programs in elementary and secondary schools. Strong emphasis will be placed on the analysis of current social studies curriculum materials.
460. *Planning Programs and Courses for Vocational Agriculture Department*. I, S. 2 hr. PR: C&I 188. Gathering data, studying the farming problems of all-day students, young farmers, and adult farmers, and planning the total program for the department.
490. *Teaching Practicum*. I, II, S. 1-3 hr. PR: Consent. Intended for graduate students with college teaching responsibility. Provides a supervised experience in a teaching situation. (Graded as S/U.)
491. *Advance Study Project in Education*. I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.
496. *Advanced Seminar*. I, II. 1 hr. PR: Consent. Opportunity for the advanced graduate student to present the student's research to faculty and/or student groups.
497. *Research*. I, II, S. 1-15 hr.
498. *Thesis*. I, II, S. 2-4 hr. PR: Consent.
499. *Colloquium in Curriculum and Instruction*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit, but who wish to participate in academic programs.

Education Foundations (Ed. F.)

300. *Sociology of Education*. I or II. 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community. (*Equiv. to Soc. & A. 232.*)
320. *Philosophic Systems and Education*. I, II, S. 3 hr. Examines different systems of educational philosophies, focusing on aims, values, and criteria of education. Stresses the application of philosophic thinking to educational language, issues, methods, and subject matter.
340. *History of American Education*. II, S. 3 hr. Major forces affecting U.S. educational developments at all school levels are examined in political, social, economic and cultural context. Major historical periods include colonial, early national, pre-post civil war and late nineteenth to mid-twentieth century.
350. *Comparative Education*. II. 3 hr. PR: Graduate standing. Compares educational systems in selected foreign countries with the United States. Examines formal and informal educational influences in historical and contemporary contexts and in socio-economic, political, and philosophical perspectives.
380. *Special Problems*. II. 1-6 hr. PR: Consent.
383. *Seminar*. I, II, S. 1-6 hr. Selected topics in historical, sociological, and philosophical foundations of education. Titles to be announced each semester.

390. *Special Topics. I.* 1-6 hr. PR: Consent.
491. *Advanced Study. I.* 1-6 hr. PR: Consent.

Technology Education (T.E.)

280. *Special Problems and Workshops. I. II. S.* 1-6 hr. To provide credits for special workshops and short intensive unit courses on special topics.
281. *Introduction to Technology.** 3 hr. An introduction to selected technical concepts and the evolution of the technical systems of transportation, communication, and production, with a focus on the relationship of these systems to technological change and the civilization process.
300. *Contemporary Problems in Transportation.** 3 hr. Technical and social cultural problems related to efforts in the development and utilization of new and improved modes of transportation.
301. *Technical Developments in Transportation.** 3 hr. Selected developments in transportation technology. Principles, concepts, and processes fundamental to the design and development of transportation systems.
310. *Contemporary Problems in Communication.** 3 hr. Technical and social cultural problems related to efforts in the development and utilization of new and improved modes of communication.
311. *Technical Developments in Communication.** 3 hr. Selected developments in communication technology; identification of principles, concepts, and processes fundamental to design and development of communication systems.
320. *Contemporary Problems in Production.** 3 hr. Technical and social/cultural problems resulting from efforts in the development and utilization of new and improved methods of producing goods and services.
321. *Technical Developments in Production.** 3 hr. Selected developments in production technology; identification of principles, concepts, and processes fundamental to the design and development of production systems.
330. *Contemporary Problems in Research and Development.* 3 hr. Research and investigation about transportation, communication, and production systems; technical and social/cultural problems related to research and development efforts.
340. *Technology in History.** 3 hr. A study of selected inventions and innovations that have altered the course of humankind, including a technical analysis of each and its contribution to the process of civilization.
344. *Technology and Society.** 3 hr. An analysis of the relationships of technical means, change, and society. Emphasis is on the influence of technical change on social institutions and culture in various societies.
350. *Industrial Arts Therapy. I. II. S.* 3 hr. Individualized instruction in industrial arts teaching techniques and therapeutic practices in rehabilitation of the handicapped.
360. *Technical Concepts — How Things Work.** 3 hr. A study of the components of technical devices and an analysis of the mechanical, electrical, optical, acoustical, chemical, and pressure elements of technical systems.
373. *Professional Development. I. II. S.* 1-6 hr. PR: Consent. Specially designed experiences for those interested in advancing professional skills in the study of technology. May be repeated. Graded S or U. Not for degree credit in programs in the College of Human Resources and Education.

Courses marked with an asterisk () are offered on a planned sequence, i.e., fall, summer, spring. Other courses are offered as required by student programs.

383. *Seminar.** I, II, S. 1-6 hr.
385. *Practicum.** I, II, S. 1-12 hr. PR: Consent.
390. *Special Topics.* I, II, S. 1-6 hr. PR: Consent.
400. *Technology: Its History and Development.** 3 hr. Major technical periods in the civilization process and the interrelationships of technological developments to the social/cultural milieu.
401. *Curriculum Development and Physical Facility Design.** I, II, S. 3 hr. PR: Consent. Development of curriculum components for education in the technologies and a study of the physical facility design requirements related to curricular implementation.
402. *Development of Instructional Materials.** I, II, S. 3 hr. PR: Consent. Design and development of media and instructional units for education in the technologies.
403. *Design in Technology.* S. 3 hr. Study of the design of technical products and systems.
404. *Readings in Technology and Culture.** 3 hr. Fundamental, historical, and contemporary ideas of the nature of technology as an area of created knowledge.
405. *Innovation and Invention.** 3 hr. A study of the innovation and invention process.
480. *Projects in Technology Education.** I, II, S. 1-6 hr. PR: Consent.
481. *Problems in Technology Education.** I, II, S. 1-6 hr. PR: Consent.
490. *Teaching Practicum.* I, II, S. 3-12 hr. PR: Consent.
491. *Advanced Study.* I, II, S. 2-4 hr. PR: Consent.
496. *Graduate Seminar.** I, II, S. 1-4 hr. PR: Consent.
497. *Research.** I, II, S. 1-4 hr. PR: Consent.
498. *Thesis.* I, II, S. 1-15 hr.
499. *Colloquium.** I, II, S. 2-9 hr. PR: Consent.

Courses marked with an asterisk () are offered on a planned sequence, i.e., fall, summer, spring. Other courses are offered as required by student programs.

SOCIAL WORK

John J. Miller, *Dean of the School of Social Work*

Allen Hall

Degree Offered: M.S.W.

Graduate Faculty: Members Ginsberg, Miller, Schneider, and Schultz. Associate Members Boo, Cohen, Isaacson, Jones, Locke, N. L. Lohmann, R. A. Lohmann, Peters, Porter, and White.

The graduate program of the School of Social Work is part of a comprehensive program of professional education in social work, including degree programs at baccalaureate and master's level, and a range of part-time and continuing educational opportunities on and off the Morgantown campus.

Opportunities are available for students to complete part of their M.S.W. degree requirements at the West Virginia College of Graduate Studies (COGS) in Charleston. Opportunities for research and education abroad are also available through the School of Social Work participation in the International Student Exchange Program.

Social work is primarily concerned with enhancing the problem-solving, coping, and developmental capacities of people, promoting effective and human operation of resources and service delivery systems, and linking people with appropriate resource and service opportunities.

The graduate program concentrates upon offering advanced specialized training for the development of programs and community leadership in rural areas and small towns. The School of Social Work is nationally recognized in the area of rural social work practice, and the faculty members regularly contribute to this field through presentations, papers, conferences, and other means.

Full-time students ordinarily complete two semesters and one six-week summer session of course work in generally required courses, specialization courses and electives, and one semester and one six-week summer session of problem-focused field instruction.

Field instruction opportunities are available throughout northern and central Appalachia, as well as in a select number of settings outside the region. Classes focus upon a blend of local, region, and national perspectives. The graduate program in social work offers enhanced educational opportunities in a number of specialized problem areas: Aging, Families, Health and Mental Health.

Graduates are employed throughout the United States and Canada. They work as individual, family, and group treatment specialists, planners, community organizers, social researchers, social work educators and administrators in a variety of programs, such as mental health clinics, hospitals, correctional institutions, courts, delinquency programs, aging programs, family counseling agencies, child protective agencies, public welfare departments, child development programs, manpower agencies, public schools, community action agencies, settlement houses, city governments, state government planning agencies, federal administrative agencies, and private research and development organizations concerned with human problems.

There has been a constant growth in the need for professional social workers. It is anticipated by the Bureau of Labor Statistics and other research bodies that the demand for social workers will continue to increase in numbers and in varieties of programs in which social workers are employed. The WVU social work curriculum is designed to help students prepare for these careers. Students are required to work closely with their academic advisers in selecting appropriate components in class and field learning to meet their individual needs.

Curriculum

Increasingly aware of the maturation of baccalaureate social work education (in which the School of Social Work has been a national leader), the graduate program is designed to simultaneously broaden and deepen the knowledge and skill levels of those with baccalaureate education or work experience in social work. (Applicants without baccalaureate education in social work may be required to complete some prerequisite courses before entering the graduate program.) In addition, incoming students must designate a specialized problem area or concentration. These are: *Health and Mental Health*, *Family*, *Aging*, and an *Alternative Concentration*.

1. *Health and Mental Health Concentration* — The Health and Mental Health Concentration provides students with a generic model of practice as adapted to the evolving field of health and mental health. Particular emphasis is

placed on community approaches to primary prevention and on the use of community support systems for the deinstitutionalized patient. Field placements emphasize the health and mental health field as a network of interrelated agencies and functions with attention to the tasks of planning, administration, community organization, direct practice, and research.

2. *Family Concentration* — The Family Concentration provides education towards the development of the knowledge, skills, and values that enable the student to perform competently in human service systems whose programs and policies directly affect family well-being. Students learn the tasks of the social worker in social service agencies, other community systems, and advocacy roles inside and outside the agency and community system. These social work roles encompass preventing and treating neglect, abuse and exploitation, developing and supervising alternative family care systems, deinstitutionalization, policy and program development, and adolescent emancipation programs.

3. *Aging Concentration* — The Aging Concentration is designed to provide training in gerontological social work with courses that emphasize an understanding of the aging process, needs, and problems of the aged, social policies and programs intended to address those problems and the nature of social work intervention with the aged. The tremendous growth of an aged population in the last few decades has created a need for trained social workers who can work with the aged. This content is provided through 9 credit hours of classes and 21 credit hours of field work. Both class and field work emphasize the role of the MSW-level practitioner as the administrative, manager or planner of services for the aged.

4. *Alternative Concentration* — The Alternative Concentration is for students who have an explicit career goal in mind that does not fit into any of the other three concentrations. Students opting for the Alternative Concentration would develop an individual contract with a school committee. Students requesting to pursue the Alternative Concentration must complete and return the "Rationale for the Alternative Concentration Form" contained in the admissions material. Each student's request will be reviewed by a school committee and the student will only be admitted to the School of Social Work under the designated alternative concentration, if the school feels it can meet his/her stated career goals.

Admissions

Students admitted to the School of Social Work graduate program fall into three categories:

A. Students with a baccalaureate degree in social work or social welfare from an accredited B.S.W. program whose cumulative grade-point average in their social work courses is 3.0 or higher (on a 4.0 scale).

B. Students with a B.S.W. degree whose cumulative grade-point average in their social work courses is below 3.0 and students with a baccalaureate degree in other fields.

C. Students with a baccalaureate degree in any field whose cumulative grade-point average is below 2.5. (See below.)

Student requesting admission must also show:

1. Proof of academic achievement. Graduate regulations require an undergraduate grade-point average of at least 2.5 for approval of candidates as a regular graduate student. An undergraduate grade-point average of less than 2.5 will be classified as *Special Provisional* for those admitted.

2. Evidence of potential to practice social work, such as commitment to human service, and a concern and ability to work effectively with people.

Applicants fitting into each of the above categories are regularly admitted to the graduate program in social work. However, important variations to prerequisite requirements and total hours required for graduation exist, and applicants are advised to read the following *carefully*:

All incoming students will be expected to demonstrate entry-level competence in professional social work after admission and before entry into required graduate course work. Five areas of competence are involved: Practice, Human Behavior, Policy, Research Methods, and Statistics.

Incoming students with B.S.W. degrees and cumulative grade-point averages in their social work courses of 3.0 or higher must only demonstrate competence in Research Methods and Statistics.

All other admitted students must demonstrate entry-level competency in each of the five areas listed above. Methods of demonstrating competence include: (1) passing a proficiency examination offered by the School of Social Work, or (2) completing a designated prerequisite course in each of the areas.

This requirement means that a total number of hours necessary for graduation may vary from 56 to 72: A B.S.W. with a grade-point average in his/her social work courses over 3.0, who passed both research and statistics examinations, would only need 56 hours in the program. A non-B.S.W., who passed none of the exemption examinations, would be required to complete a total of 72 hours. In no case would a student be required to complete more than 72 hours in the program.

Upon acceptance, each student will receive a letter stating the areas in which the student must demonstrate entry-level competence, either through passing the proficiency examination or completing the designated prerequisite courses. At that time the student will know the exact number of additional hours to be completed before beginning the 56-hour program.

Preference will be given to students who have a total of at least one year of paid and/or volunteer human service work experience.

Application Deadline

Students may enter the program in either the fall or spring semester. Applications for the fall semester must be completed by March 1. Applications for the spring semester must be completed by July 1. Applicants whose admission files are completed after the deadline date may be classified as *Special Provisional* students, and not be allowed to complete more than 12 hours of course work until their application is completely accepted.

Requirements for Master of Social Work

The degree of Master of Social Work (M.S.W.) is conferred by the University upon those students who satisfactorily complete the requirements as established by the Graduate School. These requirements are:

1. Satisfactory completion of no less than 56 semester hours which may have been earned through the WVU School of Social Work, West Virginia College of Graduate Studies, WVU Off-Campus Credit Program, or through appropriate graduate courses completed in other accredited institutions. Exceptions in this category would pertain to candidates whose degree plans required them to register for less than 20 semester hours of field instruction or for can-

didates whose earned credit entitled them to exempt from certain courses. Candidates who transfer from other accredited graduate social work programs are required to successfully complete no less than 39 semester hours (since equivalent credit hours from other institutions may not match that which is offered by WVU).

2. Students may request credit for up to 18 hours earned in graduate study in approved courses taken at other divisions of WVU; through graduate social work off-campus credit courses, or approved courses from other accredited universities. Such requests must be made at the time of application for admission and approved at that time, for students to be able to claim such credit towards the requirements of an M.S.W. degree.

3. Satisfactory completion of all components of the graduate program. All M.S.W. degree candidates must complete the following requirements.

	Hours
Advanced Practice	12
Human Diversity (required)	3
Supervision or Management (required)	3
Advanced Practice Electives	6
Social Support Systems	3
Advanced Research Practice	6
Advanced Policy Analysis	3
Field Instruction	20
Practice Concentration Courses*	6-9
(Aging, Health/Mental Health, or Children and Family. Provisions may be made for students to select an alternative program of study to these three concentrations. Alternative concentrations are individually arranged.)	
Electives**	3-6
Total Required Hours	56

*Students in the Aging concentration take So. Wk. 371, 372, and an additional concentration course selected from courses designated by the concentration. Students in the Health/Mental Health concentration take So. Wk. 374, 376, and an additional concentration course selected from courses designated by the concentration. Students in the Children and Family concentration take So. Wk. 377, 378, and an additional concentration course designated by the concentration.

**The number of elective credit hours taken will be determined by the number of hours required by your concentration; however, a total of 56 credit hours are required for the M.S.W. degree.

Social Work (So. Wk.)

- 200. *Social Welfare Policy and Services*. I, II. 3 hr. PR: So. Wk. 51 or consent. Introduces the student to the historical background and philosophical concepts which influence the development of social welfare in America. Also, students are exposed to the specific social welfare programs and services which are utilized by the people.
- 220. *Social Work Methods I, I, II*. 3 hr. PR: So. Wk. 51 or consent. Theories and concepts of intervention, including prevention and rehabilitation with individuals, families, small groups, and communities are discussed. Students examine problem areas of concern to social work and various roles through which those problems can be alleviated. Emphasis on beginning skills in interviewing, observing, recording, problem identification, and analysis.
- 313. *Social Work Research Methods*. I, II, S. 3 hr. Basic concepts in social research methods. Emphasis on conceptualization of social work problems for research, role of social science theories in research, measurement options in research design, and analysis of data.

323. *Social Support Systems*. I, II. 3 hr. PR: So. Wk. 280 or consent. Social science theories pertinent to social support system concepts. Formally organized systems and natural helping networks are considered. Program models related to particular target populations, such as mentally ill, the aged, etc., are examined.
324. *Human Service Organizations*. I, II. 3 hr. PR: So. Wk. 280 or consent. Forces that characterize the establishment, maintenance and transformation of human service agencies.
325. *Social Welfare in American Communities*. I, II, S. 3 hr. PR: So. Wk. 280 or consent. Current theory and research on social welfare institutions in American communities. The course provides a conceptual framework for community practice, with particular attention to social movements, inter-organizational relationships and strategies for social change.
333. *Social Policy Analysis*. I, II. 3 hr. PR: So. Wk. 200 or consent. Skill development in techniques of social policy analysis. Selection of analytical methods and issues offered in different sections.
341. *Social Treatment Groups*. I, II. 3 hr. PR: So. Wk. 220 or consent. The use of social relationships in small groups in treating personal problems.
342. *Task Group Processes*. I, II, S. 3 hr. PR: So. Wk. 220 or consent. The use of social relationships in small groups for problem-solving tasks.
343. *Social Work With Couples/Families*. I, II. 3 hr. PR: So. Wk. 220 or approval. Practice issues in skill development and counseling with married couples and families.
345. *Supervision in Social Work*. I, II, S. 3 hr. PR: So. Wk. 220 or approval. Functions, conflicts and dynamics of supervision of professionals, and the relationship of ethnical and value principles.
346. *Experiential Groups*. I, II, S. 3 hr. PR: So. Wk. 220 or consent. Practice issues in skill development and role playing, related concerns in psychodramatic intervention.
351. *Social Management/Rural Communities*. I, II. 3 hr. PR: So. Wk. 220 or consent. Practice issues in skill development and community organization and development with special emphasis on rural communities.
352. *Social Planning*. I, II. 3 hr. PR: So. Wk. 220 or consent. Practice issues in skill development related to social components of comprehensive planning and functional planning systems in health, aging, manpower, social service, and other areas.
354. *Social Agency and Program Administration*. I, II. 3 hr. PR: So. Wk. 220 or consent. Practice issues in skill development in programming, budgeting, organization, staffing, and control of social agencies and programs.
371. *Social Work With the Aged*. I, II. 3 hr. PR: So. Wk. 200, 220, and So. Wk. 280 or consent. Human aging as a problem in social theory, research, policy, and practice.
372. *Concepts and Theories in Social Gerontology*. I, II. 3 hr. PR: So. Wk. 371 or consent. Major conceptual and theoretical perspectives in social gerontology are applied to social work practice for the aged.
374. *Community Mental Health*. I, II. 3 hr. PR: So. Wk. 200, 220, and So. Wk. 280 or consent. An overview of the field of mental health which addresses major policy, program, practice, theory, and research issues as reflected in recent reports of the President's Commission on Mental Health. Current federal and state regulations and state plan documents are examined.
375. *Individual Consultation*. I, II, S. 1-3 hr. PR: Consent. Individual directed study to develop extensive knowledge in social work areas of student's interest.
376. *Explorations in Primary Prevention*. I, II. 3 hr. PR: So. Wk. 374 or consent. This course explores varying conceptual approaches to primary prevention, the social

science theories and research on which they are based, and their adaption to major modes of social work practice. Specific substantive knowledge problems are addressed.

377. *Introduction to Family Social Work*. I, II. 3 hr. PR: So. Wk. 200, 220, and So. Wk. 280 or consent. Describes the demography of the population at risk, identifies family theory, major programs, and services and policies. Examines gaps in services and major styles of family intervention in social work roles.
378. *Family Victimology*. I, II, S. 3 hr. PR: So. Wk. 377 or approval. The interface of social work practice in family victimology, with emphasis on victim welfare policy and service, victim compensation programs and victim prevention. Social concern for physical and sexual abuse, battery, and related topics.
380. *Special Topics*. I, II, S. 1-3 hr. Examinations of selected issues in social work and social welfare. In the past topics have included issues in public welfare policy, social work practice, implications related to the contemporary racial crisis, social welfare in the developing countries, citizen participation in social planning and change, use of groups in staff development, etc.
381. *Field Instruction*. I, II, S. 5-14 hr. PR: Consent. Field instruction and practice in selected settings under general direction of the faculty.
481. *Advanced Field Instruction I*. I, II, S. 5-14 hr. PR: Consent. Graduate field instruction in selected settings under general direction of the faculty.
482. *Advanced Field Instruction II*. I, II, S. 5-14 hr. PR: Consent. Graduate field instruction in selected settings under general direction of the faculty.
497. *Research*. I, II, S. 1-15 hr.

SOCIOLOGY AND ANTHROPOLOGY

Ann L. Paterson, *Chairperson of the Department*

Roger B. Trent, *Chairperson of the Graduate Committee*

205 Deahl Hall

Degree Offered: M.A.

Graduate Faculty: Members Althouse, Ball, Hall, Kolaja, Levine, Paterson, and Photiadis.

Associate Members Foss, Lozier, Podolefsky, Schnabel, Simoni, Starr, Trent, and Weller.

The Department of Sociology and Anthropology offers a program of study leading to the degree of Master of Arts in Sociology and Anthropology (M.A.). This degree is appropriate for students who wish to pursue research training in social science beyond the M.A. degree, as well as for those who wish to take positions in government or private agencies where data handling and research are necessary.

Admission. Applicants for admission to graduate study must have a bachelor's degree from an accredited institution. Students who do not have adequate background in sociological theory, methods, and statistics may be required to take remedial work. Applicants are required to submit transcripts from their undergraduate institutions, three letters of recommendation, and recent Graduate Record Examination aptitude scores (the appropriate advanced GRE test score is recommended). Foreign students for whom English is not the native language are required by the University to submit "Test of English As a Foreign Language" (TOEFL) scores and may be required to participate in the University's Language Orientation Sessions.

Applications should be completed by April 15 for admission to the First Semester (March 15 if an assistantship is sought), and by November 15 for ad-

mission to the Second Semester. Full-time students who are admitted "Special Provisional" will be required to complete 12 hours of approved course work with a "B" average or better within a year. Students who fail to do so will be suspended. Each spring the Department Graduate Committee will assess all students and determine who will continue in the program, with or without assistance.

Degree Requirements. Students may select one of two options leading to the M.A. (In either program at least 60 percent of the total number of required hours must be taken in courses numbered at the 300-level or above; the remainder may be at the 200-level.)

1. **Applied Social Research Option** — Thirty-six hours of course work and an Applied Research Report based on the empirical assessment of a public service program or policy. The objectives of this option are to provide: (1) substantial grounding in basic research skills; (2) an overview of the relationship between social research and social policy; and (3) specialized knowledge in at least one field of social service. This option is especially designed for students who will seek positions in government or private agencies in applied social research capacities, but it is also appropriate for those planning to pursue further academic work. In addition to a core of research skills, students will select an applied area of social service. Examples of service areas include: aging and gerontology, community development, complex organization, criminal justice systems, education, health care delivery, social impact assessment, and occupational safety. Service area courses may be taken within the department or in other units of the University. Students will take at least three courses in the same applied area.

Program in Applied Social Research: First Semester — Seminar in Social Organization, Orientation to Library and Computer Resources, Survey Research Methods, Service Area Elective; **Second Semester** — Qualitative Methods, Data Analysis, Social Systems and Social Policy Seminar, Service Area Elective; **Third Semester** — Comparison of Research Methods, Advanced Data Analysis, Service Area Elective, Service Area Elective; **Fourth Semester** — Applied Problem Research (6 hours).

2. **Thesis Option** — Thirty-six hours of course work and a thesis which meets the requirements of the Graduate School. This option is particularly appropriate for students who are interested in a theoretical problem and who intend to pursue a career in academic social science. Students electing this option will take the following courses: Contemporary Sociological Theory; Orientation to Library and Computer Resources; Survey Research Methods; Qualitative Methods; Data Analysis; Social Organizations Seminar; Thesis (6 hours); Electives (18 hours).

Sociology and Anthropology (Soc. & A.)

201. *Sociological Theory*. I or II. 3 hr. PR: 6 hr. Soc. & A. and senior standing or consent. Systematic analysis of major sociological theories viewed from the historical perspective and in terms of current research.
202. *Deviant Behavior*. II. 3 hr. PR: 6 hr. Soc. & A. or consent. Examination of the processes by which "deviance" is defined in society, and the methods of social control attempted. Provides a critical understanding of society from the perspective of those defined as "outsiders" — criminals, addicts, etc.
203. *Collective Behavior*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. Analysis of riots, demonstrations, crowd and mob behavior, and other forms of social contagion, and a study of behaviors following natural disasters and social unrest.

204. *Complex Organizations*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. The structure and functioning of large-scale bureaucratic organizations, including studies of industrial organizations, prisons, hospitals, government bureaus, and the military in contemporary society.
205. *Class, Status and Power*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. Analysis of various systems of social inequality. Emphasis on empirical studies describing social class system, distribution of status and power, and patterns of social mobility in America.
211. *Social Research Methods*. I, II, S. 3 hr. PR: Soc. & A. 1 or 5 or consent. Logic of social research, elements of research design, and problems of measurement, with emphasis on survey research methodology and data analysis.
222. *Community Development*. I or II. 3 hr. PR: Soc. & A. 122, 131, 233, or consent. Application of sociological knowledge of structure of communities for planning programs and services. Emphasis on techniques of organizing efforts for community change.
231. *Society and Health*. I. 3 hr. PR: 6 hr. Soc. & A. or consent. Health and illness behavior and the social organization of the health professions, including the problems of health-care delivery systems in the United States and in developing areas.
232. *Sociology of Education*. (Same as Ed. F. 300.) I or II. 3 hr. PR: Soc. & A. 1 or consent. Education as a social institution, cultural and class influences on education, social roles and career patterns in the school system, the school and problems of the community.
233. *Sociology of Work and Work Places*. I or II. 3 hr. PR: Soc. & A. 1 or consent. Explores the significance of work and work relations in contemporary society. Emphasis is given to the analysis of employment settings including industrial organizations.
240. *Social Change*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. Sociological analysis of current major changes in our society, of the forces underlying them, and of tensions to which they give rise. Alternative future directions; rational manipulation and planning for social change.
241. *Population Dynamics*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. Demographic analysis focusing on social causes and consequences of variations in fertility, morbidity, mortality, and migration. National and state population policies also considered. (Course will not be offered in 1981-82.)
245. *Soviet Society*. I or II. 3 hr. PR: Soc. & A. or consent. Social and cultural trends in contemporary Soviet Union. Population characteristics and ethnic and nationality diversity; the family, education, political institutions and social classes; agricultural, industrial, and scientific organization. Comparisons with U.S. society.
251. *Technology and Culture Change*. I or II. 3 hr. PR: Soc. & A. 1 or 5 or consent. The importance of tools and techniques in socio-cultural change. A range of small- to large-scale technologies is covered in primitive to modern societies.
252. *Culture and Personality*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. How different cultures shape the personalities of their members; concepts such as model personality and national character. (Course will not be offered in 1981-82.)
255. *Anthropological Theory*. I. 3 hr. PR: 6 hr. Soc. & A. or consent. Theoretical contributions of anthropology to the social sciences. Key figures of modern anthropology, i.e. Boas, Malinowski, and Mead.
256. *Field Methods*. II. 3 hr. PR: Soc. & A. 211 and Stat. 101 or consent. The distinctive craft of data gathering in cultural anthropology. Development skills in field methods and participant observation.

257. *Primate Behavior*. I or II. 3 hr. PR: 3 hr. of any behavioral science or consent. Primates as they exist in their natural habitats suggest clues to early human behavior and evolution of behavior. Case studies and comparative behavior from prosimians, monkeys, and apes to human hunters and gatherers. (Also listed as Biol. 235.)
260. *Society and Personality*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. Interaction between society and the individual's behavior. Key concepts are social role, and the social self. Focus on adult experiences and adult socialization.
261. *Criminal Justice in America*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. Critical examination of law, police, courts, and corrections (adult and juvenile); conservative reform and radical evaluations. Emphasizes such current issues and innovations as civil liberties, victimless crimes, prison reform, professionalization, community-based corrections, behavior modification.
262. *Youth and Social Change*. I or II. 3 hr. PR: 6 hr. Soc. & A. or consent. A structural-historical approach to the study of youth as both product and agent of social change. Emphasizes concepts of human development, life course transition, age stratification, birth cohort, lineage, historical period, and socio-cultural generation.
290. *Special Topics*. I, II, S. 3 hr. PR: 6 hr. Soc. & A. or consent. Courses on issues and problems of current concern. Topics change, so students may enroll more than once.
293. *Independent Study*. I, II, S. 1-3 hr. per sem. PR: 3.0 grade-point average and written departmental permission. Directed reading or research for students desiring work not available in regular course offerings.
311. *Survey Research Methods*. I. 3 hr. PR: Soc. & A. 211 and Stat. 101 or consent. Provides students with an overview of survey design including questionnaire construction, measurement and sampling theory, project management and budgeting, and report writing. Students will be required to submit a complete survey research proposal.
313. *Qualitative Methods*. II. 3 hr. Provides students with supervised field experiences in interviewing, participant observation, and other methods of qualitative data gathering, analysis, and presentation.
315. *Comparative Research Methods*. I. 3 hr. Examines the relationship between theory and research through critical comparison of the principal designs and methods used in the social sciences. Special attention to alternative strategies for studying social service institutions.
317. *Data Analysis*. II. 3 hr. PR: Stat. 300 and 311 or equiv. Using social science survey data, this course builds upon introductory statistics, computer usage, and social science theory to examine alternative methods of analyzing social science data. Makes extensive use of SPSS software package.
322. *Contemporary Sociological Theory*. I or II. 3 hr. PR: 9 hr. Soc. & A. or consent. Review of recent trends and orientations in sociology. Theory construction, typologies, mathematical models and the relationship between theory and research. Review of current literature.
372. *Sociocultural Factors in Health, Illness, and Medical Care*. II. 3 hr. PR: 9 hr. Soc. & A. or consent. Distribution of disease in the population and patterns of illness behavior. Sociological study of the health professions, community health care institutions, and the cost and organization of health services.
390. *Special Topics*. I, II. 3 hr. A graduate course offered as the need arises. Topics change so students may enroll more than once.
391. *Seminar*. I, II. 3-9 hr.

- 393. *Independent Study*. I, II, S. 1-9 hr. PR: Written departmental consent. Directed reading and/or research in a specialized area of interest.
- 394. *Thesis*. I, II, S. 1-9 hr.
- 395. *Field Work*. I, II, S. 1-6 hr. PR: Departmental consent. Supervised field work.
- 490. *Teaching Practicum*. I, II. 1-6 hr.
- 497. *Research*. I, II, S. 1-15 hr.

SPECIAL EDUCATION

Wilfred D. Wienke, *Chairperson of the Department*
606 Allen Hall

Degrees Offered: M.A., Ed.D.

Graduate Faculty: Members Clements, Lombardi, Nardi, and Platt. Associate Members Kaczmarek, Orelove, Shuck, and Wienke.

All applicants must comply with the requirements of the Graduate School, the College of Human Resources and Education, and the Department of Special Education.

The Special Education programs at the master's degree level are designed to prepare master-clinical teachers of special education children and adults, and to provide initial training for the preparation of future supervisors and administrators of public-school special education programs.

The post-master's Special Education programs leading to the Certificate of Advanced Study (C.A.S.) and the Doctor of Education (Ed.D.) are individually prescribed programs designed to prepare supervisors, administrators, researchers and teacher trainers. The advanced training of graduates who major in special education at the doctoral level may prepare them for positions in higher education.

Applicants who wish to pursue master's degree level Special Education Teacher Certification programs in Mental Retardation, Specific Learning Disabilities, or Behavioral Disorders (K-12), must complete approved programs based on the current State Standards for Accreditation of Teacher Education Programs (June, 1974.) Applicants interested in the program in Severely and Profoundly Handicapped should contact the department chairperson for specific information.

Students who hold a valid Professional Teaching Certificate for Elementary Education or Early Childhood Education will be required to satisfy the following portions of the Special Education master's degree programs for certification in K-12 programs in mental retardation, behavioral disorders, and specific learning disabilities: the core area requirements, and the teaching certification area requirements for their program area.

Students who hold a valid Professional Teaching Certificate for any specialization other than elementary or early childhood will be required to satisfy the following portions of the Special Education master's degree programs for certification in K-12 programs in mental retardation, behavioral disorders, and specific learning disabilities: the core area requirements, the teaching certification area requirements for their program area, and 25 hours of the approved program in basic skills. Effective February, 1979, students may satisfy the basic skills component by making a score of 630 on the area examination, Education in the Elementary School of the National Teacher Examination, or by satisfying the approved program in basic skills.

Students who hold no valid Professional Teacher Certificate will be required to satisfy the following portions of the Special Education master's degree programs for certification in K-12 programs in mental retardation, behavioral disorders, and specific learning disabilities: the core area requirements, the teaching certification area requirements for their program area, 25 hours of the approved programs in basic skills, and 6 hours of professional education. Students may satisfy the basic skills component by making a score of 630 on the area examination. Education in the Elementary School of the National Teacher Examination, or by satisfying the approved program in basic skills. The professional education component may be satisfied by the student by making a weighted score of 620 on the Commons Examination with a sub-total of 248 on the Professional Education, and a weighted subtotal of 372 on General Education of the National Teacher Examination, or by satisfying the approved program in professional education.

Curriculum for Special Education

Master of Arts (36 Semester Hours Minimum)

A. Core Area Requirements	Hours
(12 Semester Hours in All Master Degree Programs)	
Sp. Ed. 250 — Survey of Exceptional Children and Adults	3
Sp. Ed. 260 — Curriculum and Methods for Special Education	3
C&G 305 — Theory and Practice of Human Appraisal	3
Psych. 281 — Abnormal Psychology or	
Psych. 263 — Introduction to Personality or	
Sp. Ed. 264 — Psychology of Adjustment	3
SPA 350 — Speech & Lang. Disorder Assessment & Remed.	3
Total	15
B. Teaching Certification Mental Retardation Area Requirements	
Sp. Ed. 255 — Introduction to Mental Retardation	3
Sp. Ed. 305 — Mathematics for the Mentally Retarded	3
Sp. Ed. 306 — Reading for Mentally Retarded Children	3
Sp. Ed. 487 — Practicum	3-6
Total	12-15
Elective Requirements Mental Retardation Area	6-9
C. Teaching Certification Learning Disabilities Area Requirements	
Sp. Ed. 330 — Introduction to Specific Learning Disabilities	3
Sp. Ed. 331 — Evaluative Techniques in Specific Learning Disabilities	3
Sp. Ed. 332 — Teaching Strategies of Specific Learning Disabilities	3
Sp. Ed. 487 — Practicum	6
Rdng. 342 — Reading Diagnosis and Prescription in Learning Disabilities	3
Total	18
Elective Requirements Learning Disabilities Area	3
D. Teaching Certification Behavioral Disorders Area Requirements	
Sp. Ed. 340 — Introduction to Behavioral Disorders	3
Sp. Ed. 341 — Behavioral Dynamics in the School and Community	3
Sp. Ed. 342 — Curriculum and Methods for the BD Child	3
Sp. Ed. 487 — Practicum	6
Total	15
Elective Requirements Behavioral Disorders Area	6

E. Problem or Thesis Area Requirements

Stat. 311 — Statistical Methods or	
Ed. P. 320 — Introduction to Research	3
Sp. Ed. 395 — Problem in Special Education or	
Sp. Ed. 497 — Research	3-6
Sp. Ed. 480 — Seminar	3
Total	9-12
Elective Requirements	12-15

F. Approved Electives

C&G 305, 464	
C&I 330, 333, 340, 438	
Ed. F. 320, 340	
Ed. P. 300, 320, 330, 333, 341, 342, 343, 350, 420, 440, 450, 451	
Psych. 263, 264, 271, 281, 282, 322, 423	
Rdng. 283, 321, 324, 325, 330, 331, 340, 342	
Sp. Ed. 262, 265, 271, 280, 281, 305, 306, 330, 331, 332, 340, 341, 342, 365, 381, 395, 480, 487, 496	
Stat. 311, 312	

Special Education (Sp. Ed.)

250. *Survey of Exceptional Children and Adults*. I, II, S. 3 hr. PR: Consent. Introduction to all areas of exceptionality. Definition, psychological and educational characteristics, and social and vocational adjustment.
255. *Introduction to Mental Retardation*. I, II, S. 3 hr. PR: Consent. Historical, etiological, social, educational, and vocational aspects of mental retardation.
260. *Curriculum and Methods for Special Education*. I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Organization of instruction and adaptation of teaching methods in the several curricula areas and the construction of materials.
262. *Curriculum and Methods for the Trainable Mentally Retarded*. I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Analysis of special problems of curriculum development for the trainable child and adult and provisions for development of original construction of curricula materials. (Course not offered in 1981-82.)
265. *Industrial Arts in Special Education*. II, S. 3 hr. Experimentation with industrial arts and crafts suitable for instruction in special education classes. Discussion of factors involved in selection and manipulation of such media as leather, plastics, ceramics, wood, and metal. (Course not offered in 1981-82.)
271. *Curriculum, Materials, and Methods for Mentally Gifted*. I, II, S. 3 hr. History and philosophy, identification, curriculum, materials and methods of working with mentally gifted.
280. *Student Teaching Clinical Experience in Special Education*. I, II, S. 1-6 hr. PR: Consent. Student teaching with the mentally retarded.
281. *Special Problems and Workshop in Special Education*. I, II, S. 2-4 hr. PR: Consent. To take care of credits for special workshops and short intensive unit course on methods, supervision, and other special topics.
305. *Mathematics for the Mentally Retarded*. I, S. 3 hr. PR: Consent. Materials and methods for teaching mathematics to the mentally retarded child. (Course not offered in Fall, 1981-82.)
306. *Reading for Mentally Retarded Children*. II, S. 3 hr. Designed especially for majors in special education. Emphasizes the techniques, methods, and materials most ef-

fective for teaching reading to mentally retarded. (Course not offered in Spring 1981-82.)

320. *Curriculum for the Severely Handicapped*. I. 3 hr. PR: Consent. Focuses on evaluation of curricula and programs for severely and profoundly handicapped students. Task analysis and programming of longitudinal skill sequences are discussed for the following skill areas: pre-academics, academics, motor, self-help, and social.
321. *Assessment/Instruction Programming: Severely Handicapped*. I. 3 hr. PR: Consent. Focuses on the assessment, instruction, and evaluation of severely handicapped students. Emphasis on techniques for training and on methods for instructional programming. Course activities include readings, discussion, and written programming exercises.
322. *Characteristics and Methods: Physically Handicapped*. II. 3 hr. PR: Consent. Presents information via lectures, readings, demonstrations, and practicum on problems commonly found in severely handicapped students, particularly cerebral palsy, and focuses on educational implications in both public school and residential settings.
323. *Teacher/Parent Consultation: Handicapped Populations*. II. 3 hr. PR: Consent. Focuses on services to handicapped populations beyond direct instruction including inservice training, educational planning conferences, special services, program planning, and parent involvement in education.
324. *Classroom-Based Language Intervention for the Handicapped*. II. 3 hr. PR: Consent. Designed to prepare teachers and professionals from related fields to design and implement language/communication intervention programs with handicapped persons who manifest moderate to profound impairments.
325. *Secondary/Adult Programming: Severely Handicapped*. S. 3 hr. PR: Consent. Focuses on the education of secondary-level and adult severely handicapped persons. Methods and materials in areas of vocational training, home living, community living, recreational and leisure skills, and sex education.
330. *Introduction to Specific Learning Disabilities*. I, II, S. 3 hr. PR: Consent. Historical, etiological, educational, and legislative aspects of, and multidisciplinary approaches to, the learning disabled child.
331. *Evaluative Techniques in Specific Learning Disabilities*. I, II, S. 3 hr. PR: C&G 305 and consent. Administration, interpretation, report writing, and educational implications of selected testing procedures appropriate to the diagnosis of learning disabilities.
332. *Teaching Strategies of Specific Learning Disabilities*. I, II, S. 3 hr. PR: Sp. Ed. 330, consent. Curriculum planning, informal diagnosis, techniques, teaching strategies in specific areas, opportunities to use strategies in student designed programs.
340. *Introduction to Behavioral Disorders*. I, II, S. 3 hr. PR: Consent. Historical trends in the education of the behaviorally disordered child. Educational and behavioral management techniques and trends for the future.
341. *Behavioral Dynamics in the School and Community*. I, II, S. 3 hr. PR: Consent. Theories of behavioral dynamics, including several distinct approaches, which relates to specific problems in the school, home, and community. Agencies available to the behaviorally disordered child and the child's family.
342. *Curriculum and Methods for the Behaviorally Disordered Child*. I, II, S. 3 hr. PR: Consent. Development of appropriate curriculum based upon individual needs of the child. Practical application of a variety of methods used in the instruction of the behaviorally disordered child in the classroom. Research and data collection case studies.

365. *Administration and Supervision of Programs for Exceptional Children.* I, II, S. 3 hr. PR: Consent. Administration and supervision with attention to: selection and placement procedures; facilities and equipment; local, state, federal legislation; and philosophy and recent research.
381. *Special Topics.* I, II, S. 1-6 hr. PR: Consent. Special topics or research in mental retardation and in exceptional children and adults.
395. *Problem in Special Education.* I, II, S. 3 hr. Research for master's degree in special education.
480. *Seminar.* I, II, S. 1-6 hr. PR: Consent. Special topics concerned with the educational, sociological, and psychological aspects of special education.
487. *Practicum.* I, II, S. 1-12 hr. PR: Consent. Internship, advanced student teaching and administration and supervision practicum.
496. *Project in Special Education.* I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Special Education.
497. *Research.* I, II, S. 1-15 hr.

SPEECH COMMUNICATION

James C. McCroskey, *Chairperson of the Department*

130 Armstrong Hall

Degree Offered: M.A.

Graduate Faculty: Members P. A. Anderson, Davis, McCroskey, Richmond, Rockenstein, Scott, Shibley, and Wheelless. Associate Members J. F. Andersen, Morganstern, Portnoy, and Young.

Master of Arts (M.A.)

The Department of Speech Communication offers work leading to the degree of Master of Arts (M.A.) in communication theory and research. Persons who possess a bachelor's degree from an accredited college or university may be admitted to the program. Qualified graduate students from a variety of disciplines are admitted to the program. The master of arts degree program is intended to qualify the student to:

1. Assume a variety of professional roles in educational, industrial, governmental, or media institutions.
2. Teach the subject matter in high school and/or college.
3. Undertake advanced training toward a doctorate in the behavioral sciences.

In addition to the general requirements of the Graduate School, the graduate student in speech communication must meet the following departmental requirements:

1. Successful completion of the minimum number of required graduate hours as set forth in Program A, B, or C, below.
2. Maintain a minimum grade-point average of 3.0.

Applicants for admission must specify the program they wish to pursue.

Program A — Thesis Program

All students planning to continue graduate study past the M.A. level are encouraged to enter this program. The following is required:

1. At least 36 hours of graduate credit, 30 of which must be in the Department of Speech Communication. A maximum of 6 hours of thesis credit will be allowed.

2. Completion of Spch. 401 and 420.
3. A thesis.
4. An oral examination on the thesis.

Program B — Non-Thesis Program

All students planning a professional career in a field other than education are encouraged to enter this program. This is normally a terminal degree program in speech communication.

1. A minimum of 36 hours of course work with at least 30 in the Department of Speech Communication.
2. Completion of Spch. 401 and 420.
3. Successful completion of written and oral comprehensive examinations: (a) Comprehensive examinations draw upon broad course concepts as applied to theoretical and practical problems in communication; (b) The content and form of the comprehensive examinations are tailored for the individual student by the student's advisory committee.

Program C — Non-Thesis Program

All students planning a professional career in elementary or secondary education are encouraged to enter this program. This is a terminal degree program in speech communication.

1. A minimum of 33 hours of course work with at least 21 hours in the Department of Speech Communication and at least 6 hours in the College of Human Resources and Education.
2. Completion of a seminar on communication in the classroom.
3. Successful completion of written and oral comprehensive examinations: (a) Comprehensive examinations draw upon broad course concepts as applied to theoretical and practical problems of communication in elementary and secondary education; (b) The content and form of the comprehensive examinations are tailored for the individual student by the student's advisory committee.

Speech Communication (Spch.)

201. *Principles of Communication Education*. I, II, S. 3 hr. PR: 15 hr. speech communication. Literature, principles, and current practices of communication education in public schools with directed application. Intended for teachers in communication and language arts.
206. *Advanced Study in Nonverbal Communication*. I, II. 3 hr. PR: Spch. 106. Functions of nonverbal communication including status, power, immediacy, relationship development, regulation, turn-taking, leakage and deception, intuition, person perception, and emotional expressions.
221. *Persuasion*. I, II. 3 hr. PR: Spch. 11. Theory and research in persuasion, emphasizing a critical understanding and working knowledge of the effects of social communication on attitudes, beliefs, and behavior.
275. *Communication Problems of Children*. I, II, S. 3 hr. PR: Spch. 11. Primarily for elementary and secondary school teachers and language arts supervisors. Normal maturational development of listening and speaking skills, their relationships to language acquisition, and influence upon achievement.
281. *Media in Communication and Education*. I, II, S. 3 hr. Use of the media in educational and other communication environments with emphasis on communication processes and principles relevant to television and film.
361. *Communication in the Classroom*. I, II, S. 3 hr. PR: Teaching experience or consent. Role of interpersonal communication in classroom environment, with particular

- emphasis on communication between students and teachers. Recommended for elementary, secondary, and college teachers in all fields.
362. *Nonverbal Communication in the Classroom*. I, II, S. 3 hr. PR: Spch. 361. Impact of nonverbal communication behaviors of students and teachers on teacher-student interaction and student learning. Recommended for elementary, secondary, and college teachers in all fields.
 363. *Communication in the Educational Organization*. I, II, S. 3 hr. PR: Spch. 361. Problems of communication within educational organizations with emphasis on elements that impact educational change, conflict management, and interpersonal influence. Recommended for elementary, secondary, and college teachers in all fields.
 370. *Interpersonal Communication: Theory and Research*. I, II, S. 3 hr. PR: Consent. Survey of the theory and research in dyadic interpersonal communication. Attention to accuracy, coordination, and congruency models with emphasis upon relational communication and intimate communication in interpersonal relationships.
 371. *Theory and Research in Language*. II. 3 hr. Syntactics, semantics, and pragmatics of language behavior. Analyses of contemporary linguistic theories.
 372. *Theory and Research in Mass Communication*. I, II. 3 hr. Mass communication from a consumer's viewpoint. Use of consumer-oriented mass media research also stressed.
 373. *Theory and Research in Persuasion*. I, II, S. 3 hr. Various theories and principles of persuasion with emphasis on contemporary research literature.
 374. *Theory and Research in Diffusion and Social Change*. I, II. 3 hr. Advanced seminar in communication and change in various cultures. Special emphasis on research in diffusion of innovations.
 376. *Theory and Research in Organizational Communication*. I, II. 3 hr. Contemporary research linking communication variables and networks to organizational change, effectiveness, leadership, power, and management practices. Analysis of communication problems within a variety of organizations.
 377. *Small Group Theory and Practice*. I, II, S. 3 hr. Specific research areas in interpersonal communication with intensive emphasis on small groups.
 401. *Introduction to Graduate Study in Human Communication*. I. 3 hr. Major emphasis on designing and conducting experimental and laboratory research in human communication. Computer applications to social science research also given consideration. Should be taken first semester of graduate study.
 402. *Advanced Seminar in Research Methods*. II. 3 hr. PR: Spch. 401. Research techniques necessary to conduct original communication research. Emphasis on advanced statistical techniques.
 420. *Survey of Human Communication Theory*. I. 3 hr. Broad overview of contemporary theories in human communication. Should be taken first semester of graduate study.
 433. *Special Topics*. I, II, S. 3-12 hr. PR: Consent. Thorough study of special topics in human communication including interpersonal and small group, language, intercultural, organizational, persuasion, and mass communication, nonverbal communication, and communication education.
 475. *Independent Study*. I, II, S. 1-3 hr. PR: Consent. Open to graduate students pursuing independent study in communication.
 491. *Advanced Study*. I, II, S. 3 hr. Advanced study in a variety of areas in human communication.

496. *Seminar in Human Communication*. I, II, S. 3-9 hr. Current problems and research in human communication.
497. *Research*. I, II, S. 1-15 hr.
499. *Thesis*, I, II, S. 3-6 hr.

SPEECH PATHOLOGY AND AUDIOLOGY

Norman J. Lass, *Chairperson of the Department*
805 Allen Hall

Degrees Offered: M.S., Ed.D.

Graduate Faculty: Members Davis and Lass. Associate Members Atkins, Bodenheimer, Carlin, Kaczmarek, Ruscello, St.Louis, and Tekieli.

Master of Science

Students applying for programs leading to degrees in Speech Pathology and Audiology must comply with requirements of the Graduate School, the College of Human Resources and Education, and the Department of Speech Pathology and Audiology.

Of the applicants under consideration, the Speech Pathology and Audiology Graduate Affairs Committee will accept those who they believe will meet with success in the graduate program. The number of applicants accepted will depend upon the number of qualified applicants, the size of the Speech Pathology and Audiology graduate faculty, and the facilities available for acceptable academic, clinical, and research training.

If the student has 5 or more semester hours of C or below, the student will be dismissed from the program with no probationary status.

In addition to the requirements for the Master of Science degree, as listed under the Human Resources and Education section, the specific requirements in Speech Pathology and Audiology are:

1. A minimum of 42 semester hours of approved graduate courses (including 6 hours for clinical practicum) in speech and hearing sciences, speech pathology, audiology, and other related areas is required to attain professional competence.

In addition, the student is required to take 3 semester hours of clinical practicum during each regular semester and 2 semester hours of practicum during the summer. Six of these hours will count toward the 42-semester hour requirement.

The student must achieve not less than a 3.0 grade-point average for all courses taken for credit toward the graduate degree.

2. Successful performance on comprehensive examinations according to Graduate School and departmental standards.

3. Demonstration of professional competence in speech and/or hearing as measured by fulfillment of the academic and clinical practicum requirements established by the faculty.

4. A minimum of four semesters is required for master's candidates with a background in speech and hearing. Two of these four semesters may include summer sessions. For candidates without a background in speech and hearing, a minimum of six semesters is required for completion of the master's degree.

Doctor of Education in Speech Pathology and Audiology

Programs for the Doctor of Education (Ed.D.) in Speech Pathology and Audiology are tailored to meet the particular needs of students and their professions. Interested students should contact the Chairperson of the Department of Speech Pathology and Audiology

Accreditation

The Department of Speech Pathology and Audiology is accredited by the Education and Training Board (ETB) of the American Speech-Language-Hearing Association. Accreditation is for both the speech pathology and audiology training programs. The speech pathology and audiology training programs at WVU are the only accredited programs in West Virginia.

Speech Pathology and Audiology (SPA)

210. *Manual Communication*. I, II. 3 hr. PR: Consent. Development of skills needed to communicate in sign language. Includes the manual alphabet, basic number concepts, and the basic vocabulary of traditional American signs.
220. *Audiological Assessment*. I, II. 4 hr. PR: Consent. Physics of acoustic signal production; introduction of basic audiometric techniques and interpretation.
222. *Hearing Conservation*. II. 2 hr. PR: SPA 220 or consent. Identification audiometry for infants, pre-school, and school-age children; hearing conservation in industry.
223. *Aural Rehabilitation*. II. 3 hr. PR: SPA 220 or consent. Rehabilitative approaches to management in the auditorially handicapped individual. Medical, audiological, and social aspects of rehabilitation. Procedures of speech reading and auditory training will be examined and evaluated.
241. *Introduction: Speech and Hearing Practicum*. I. 2 hr. PR: SPA 50 or consent. Routine clinical and administrative procedures in speech pathology and audiology presented, emphasizing observation, report writing, record keeping, equipment demonstration, and test administration, scoring, and interpretation.
250. *Speech-Language-Hearing: Development-Disorders*. I, II, S. 3 hr. (Non-majors). PR: Consent. Discussion of normal processes and disorders of speech, language, and hearing in children and adults. Orientation course for students and teachers in early childhood, elementary, and secondary education, language arts specialists, psychologists, and rehabilitation specialists.
251. *Cleft Palate and Voice Disorders*. II. 3 hr. PR: SPA 50 or consent. Normal vocal production and embryological development of the face and palate considered. Nature and etiology of disorders of cleft palate and voice, diagnosis, and general goals of therapy are introduced.
252. *Stuttering*. I. 3 hr. PR: SPA 50. Development of normal fluency versus nonfluency examined in addition to the nature, etiology, theories, classification, and prognostic indicators of stuttering. General formal and informal assessment, treatment, and counseling procedures introduced.
253. *Cerebral Palsy and Aphasia*. I. 3 hr. PR: SPA 50 or consent. Speech and language disorders related to cerebral injury, with emphasis on nature and etiology of cerebral palsy and aphasia. Diagnosis and general goals of therapy introduced.
254. *Language Acquisition and Behavior*. I. 3 hr. Normal processes involved in the acquisition of language, including the development of phonological, semantic, and syntactical systems. Application of these processes to the diagnosis and treatment of language disorders are included.

257. *Public School Clinical Programs*. II. 3 hr. PR: SPA 50 or consent. Organization and structure of clinical programs in public school settings. Discussion of state and federal regulations, case selection, scheduling, program planning, and other administrative matters.
260. *Language Disorders In Children*. I. 3 hr. PR: SPA 254 or consent. Assessment and remediation procedures are examined. Utilization of current tests and analysis procedures in diagnosis are presented. Treatment approaches include commercially available programs and student-developed treatment strategies.
263. *Preschool Deaf Child*. I. 3 hr. PR: Consent. Importance of early detection and education, language development of congenitally deaf child, and parents' role in early childhood education.
281. *Special Topics*. I, II, S. 1-6 hr. per sem. PR: Consent. Independent study in speech pathology, audiology, and speech and hearing sciences.
282. *Clinical Practice in Speech*. I, II, S. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of speech disorders. (May be taken for a maximum of 3 semester hours per semester for undergraduate or graduate credit.)
283. *Clinical Practice in Audiology*. I, II, S. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of hearing disorders. (May be taken for a maximum of 3 semester hours per semester for undergraduate or graduate credit.)
321. *Structure and Function of the Auditory System*. I. 3 hr. PR: Consent. Detailed study of the gross and microscopic anatomy of the auditory system, and detailed investigation of physiological aspects of auditory sensitivity and acuity.
322. *Advanced Audiological Assessment*. I. 3 hr. Various audiological techniques utilized in differential diagnosis of auditory dysfunctioning. Administration and interpretation of diagnostic techniques.
325. *Hearing Aids*. II. 3 hr. PR: SPA 322. Electronic design of amplification systems and acoustics analysis of amplification systems. Hearing aid evaluation procedures.
326. *Pediatric Audiology*. II. 3 hr. A study of the development of the auditory response and hearing problems of early childhood. Student will learn the construction and application of specialized assessment techniques suitable for the pediatric patient.
327. *Pathologies of the Auditory System*. S. 3 hr. PR: Consent. Investigation of the nature and etiology of auditory system pathologies from the external ear to the auditory cortex and their audiological manifestation.
330. *Industrial and Environmental Audiology*. S. 3 hr. A study of various noise parameters, instrumentation for noise measurement, and measurement techniques. Effects of noise on man and industrial hearing conservation procedures discussed.
340. *Experimental Phonetics*. II. 3 hr. PR: SPA 152 or consent. Discussion of contemporary topics in the speech and hearing sciences, including acoustic and physiological phonetics.
343. *Neurophysiological Basis of Speech and Language*. I. 3 hr. PR: SPA 154, 253, or consent. General and typographic anatomy of CNS, with special attention to motor and sensory systems as they apply to speech, hearing, and language.
344. *Neuropathologies of Speech and Language*. S. 3 hr. PR: SPA 343. Explores methods of identifying and treating speech and language problems associated with non-progressive and progressive neurological disorders, including cerebral palsy, Parkinson's disease, multiple sclerosis, muscular dystrophy, amyotrophic lateral sclerosis, Bell's palsy, and myasthenia gravis.

350. *Speech and Language Disorders: Assessment-Remediation*. I, II. 3 hr. PR: SPA 250 or consent. Familiarizes the student with the following aspects of speech and language disorders: causes, characteristics, assessment, remediation techniques, and their incorporation into individualized educational programs.
351. *Advanced Voice Disorders*. I. 3 hr. PR: SPA 251 or consent. Management of vocal behavior involved in functional and organic voice disorders. Etiology and pathogenesis, clinical features, history taking, and development of critical listening skills emphasized.
352. *Advanced Stuttering Disorders*. II. 3 hr. PR: SPA 252 or consent. Course content examines factual information and classifications of stuttering. Formal and informal diagnostic techniques and treatment procedures are detailed for individuals who display primary, transitional and secondary stuttering behaviors. Patient and family counseling are reviewed.
353. *Advanced Study: Aphasia*. II. 3 hr. PR: SPA 343 or consent. Advanced investigation of the etiology, diagnosis, nature, and therapeutic approaches of aphasia, agnosia, apraxia, and dysarthria.
354. *Language Disorders in Children*. S. 3 hr. PR: SPA 254. Explores assessment and remediation procedures for language disorders in children. Emphasizes "formal" and "informal" language tests, and various treatment approaches, including traditional methods, psycholinguistic teaching procedures and behavior modification techniques.
355. *Advanced Study: Cleft Palate*. S. 3 hr. PR: SPA 251 or consent. Investigation of the etiology, diagnosis, nature, and therapy approaches of communicative disorders in persons with cleft palate.
356. *Advanced Articulation Disorders*. II. 3 hr. PR: SPA 156 or consent. Explores the merits of various methods of assessing and treating articulation disorders. Prognostic indicators, behavior modification techniques, and distinctive feature analysis are emphasized.
373. *Professional Development*. I, II, S. 1-6 hr. (May be repeated for credit.) PR: Departmental approval. Specially designed experiences for those interested in advancing professional skills in a particular specialty. (Graded as S/U.) (Not for degree credit in programs in the College of Human Resources and Education.)
382. *Advanced Clinical Practice in Speech*. I, II, S. 1-6 hr. PR: Consent. Emphasis on diagnosis of speech disorders and appropriate therapeutic follow-up. Patient staffing experience in a multi-disciplined environment.
383. *Advanced Clinical Practice in Audiology*. I, II, S. 1-6 hr. PR: Consent. (May be taken in conjunction with SPA 322.) Supervised experience in administration and interpretation of audiological evaluative procedures. Application of therapeutic techniques in aural rehabilitation.
387. *Special Topics*. I, II, S. 1-6 hr. (May be repeated for credit.) PR: Consent. Open to graduate students in speech pathology and audiology who are pursuing independent problems in that field.
480. *Seminar*. I, II, S. 1-6 hr. PR: Consent. Topics vary from semester to semester to meet student needs. Organic speech impairment, speech pathology research, aural rehabilitation research, medical audiology research, etc.
497. *Research*. I, II, S. 1-15 hr.

STATISTICS

Donald F. Butcher, Chairperson of the Department

424 Hodges Hall

Degree Offered: M.S.

Graduate Faculty: Members Butcher, Dowdy, Gunel, Harner, Krall, Townsend, and Wearden. Associate Members Hobbs and Thayne.

The Department of Statistics and Computer Science offers a Master of Science (M.S.) degree with a major in Statistics. The master of science degree is intended to qualify the student to: (1) assume a professional role in an educational, industrial, or governmental research project; (2) teach in a junior or senior college; or (3) undertake advanced training toward a doctorate in statistics or one of the quantitative fields of science.

Because many students receive baccalaureate degrees from colleges which do not offer undergraduate programs in statistics and because historically statistics has been primarily a field of graduate education, a student does not need a degree in statistics to enter the M.S. degree program in statistics. In fact, a good background in engineering, mathematics, or science is reasonable preparation for graduate work in statistics.

Two options are available for students seeking a Master of Science in Statistics. The two options are:

1. *Problem Report Option*: At least 36 hours of course work including 3 hours of credit for a problem report.

2. *Thesis Option*: At least 30 hours of course work including 6 hours of credit for a thesis.

Students are expected to know the material contained in the following courses upon admission to the program. Otherwise, these deficiencies must be removed as early as possible in the student's degree program.

1. Single and Multivariable Calculus (Math. 15, 16, 17 or equiv.)

2. Linear or Matrix Algebra (Math. 241 or Stat. 223 or equiv.).

Minimum required courses for either option are:

1. Stat. 361, 362, 496.

2. Fifteen hours from Stat. 312, 313, 341, 351, 371, 381.

3. One course from Stat. 441, 451.

4. One course from Stat. 490, 492.

Credit towards the degree requirements will not be given for Stat. 311.

All students must pass a final oral examination over the problem report of thesis and course work. Students are encouraged to request a written examination over foundation material during the first three weeks of the semester in which they hope to graduate. All written examinations will be given during the last month of the semester in which they are requested. The final oral examination, for those students passing a written examination over foundation material, will have less emphasis on course work. Foundation material for the oral and/or written examination(s) is contained in Stat. 312, 313, 341, 351, 361, 362, 371, and 381.

More information concerning graduate studies may be found in "Graduate Programs in Statistics and Computer Science" available from the department.

Statistics (Stat.)

212. *Intermediate Statistical Methods*. I, II. 3 hr. PR: Stat. 101. Extension of basic concepts of statistical inference: estimation and hypothesis testing for two populations,

multiple regression and correlation, curvilinear regression, nonparametric tests, analysis of variance and covariance.

213. *Introductory Design and Analysis*. I. 3 hr. PR: Stat. 212. Introduction to the linear model, the complete and fractional factorial experiment, and the completely random, randomized complete block, Latin square, and split plot experimental designs.
221. *Statistical Analysis System (SAS)*. II. 3 hr. PR: Stat. 101. Introduction to the use of the Statistical Analysis System (SAS), a statistical computer program. Students will perform statistical data analysis, data file modifications, and statistical report writing.
223. *Applied Matrix Algebra*. I. 3 hr. PR: Math. 18 or 51. Elementary matrix concepts and operations, vector spaces, characteristic roots and vectors, generalized inverses, systems of linear equations, patterned matrices, orthogonal and other special matrices. (Equiv. to Com. S. 223.) (Course will not be offered in 1981-82.)
231. *Sampling Methods*. I. 3 hr. PR: Introductory course in statistics. Methods of sampling from finite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single and multistage sampling procedures.
251. *Data Analysis*. II. (Alternate Years.) 3 hr. PR: Stat. 213. Computer analysis of simulated or real unbalanced data using a matrix approach to linear models. The techniques will include least squares analysis of variance and covariance, multiple and polynomial regression, and multiple discrimination.
261. *Statistics and Probability 1*. I. 3 hr. PR: Math. 16. Events, random variables, discrete and continuous probability distributions. Expected value, moment generating functions, special probability distributions. Sampling including random samples and distributions of certain functions of random variables. The Central Limit Theorem.
262. *Statistics and Probability 2*. II. 3 hr. PR: Stat. 261. An introduction to statistical inference. Properties of estimators and techniques of estimation. Hypotheses testing including the Neyman-Pearson lemma and likelihood ratio tests. Regression and correlation including least squares. Selected topics.
264. *Fundamentals of Statistical Theory*. II. 3 hr. PR: Math. 16 or equiv., and introductory statistics. Random variables and their probability distributions. Properties of estimators and methods of estimation. Principles of hypothesis testing.
291. *Special Topics*. I, II, S. 1-6 hr. Advanced study of special topics in statistics.
300. *Statistical Package: Social Sciences*. I. 2 hr. PR: Stat. 311 or equiv. Introduction to the use of the Statistical Package for the Social Sciences (SPSS), a statistical computer program.
311. *Statistical Methods 1*. I, II. 3 hr. PR: Math. 3. Statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformations, F and Chi-square distributions, analysis of variance and multiple comparisons. (Equiv. to Ed. P. 311 and Psych. 311.)
312. *Statistical Methods 2*. I, II. 3 hr. PR: Stat. 212 or 311 or equiv. Completely random, randomized complete block. Latin square and split-plot experimental designs. Unplanned and planned multiple and orthogonal comparisons for qualitative and quantitative treatments and factorial arrangements. Multiple linear regression and covariance analysis. (Equiv. to Ed. P. 312 and Psych. 312.)
313. *Design of Experiments*. II. 3 hr. PR: Stat. 312 or equiv. Expected mean squares, power of tests and relative efficiency for various experimental designs. Fixed, random, and mixed models. Use of sub-sampling, covariance and confounding to increase power and efficiency.

341. *Applied Multivariate Analysis*. I. 3 hr. PR: Stat. 212 or 311 or equiv. Introduction to Euclidean geometry and matrix algebra, multiple and multivariate regression including multiple and canonical correlation, the k-sample problem including discriminant and canonical analysis, and structuring data by factor analysis, cluster analysis, and multidimensional scaling.
351. *Applied Regression Analysis*. I. 3 hr. PR: Stat. 312. Matrix approach to linear and multiple regression, selecting the "best" regression equation, model building, and linear models approach to analysis of variance and analysis of covariance.
361. *Theory of Statistics* 1. I. 3 hr. PR: Math. 17. Probability and random variables, univariate and multivariate distributions, expectations, generating functions, marginal and conditional distributions, independence, correlation, functions of random variables including order statistics, limiting distributions, and stochastic convergence.
362. *Theory of Statistics* 2. II. 3 hr. PR: Stat. 361. Techniques of point and interval estimation, properties of estimates including bias, consistency, efficiency and sufficiency; hypothesis testing including likelihood ratio tests and Neyman-Pearson Lemma; Bayesian procedures, analysis of variance and nonparametrics.
371. *Introduction to Exploratory Data Analysis*. I. (Alternate Years.) 3 hr. PR: An introductory statistics course. Basic ways in which observations given in counted and measured form are approached. Pictorial and arithmetic techniques of display and discovery. Methods employed are robust, graphical, and informal. Applications to social and natural sciences.
381. *Nonparametric Statistics*. II. 3 hr. PR: Stat. 311 or equiv. Distribution-free procedures of statistical inference. Location and scale tests for homogeneity with two or more samples (related or independent); tests against general alternatives.
441. *Multivariate Statistical Theory*. II. (Alternate Years.) 3 hr. PR: Stat. 361 or consent. Euclidean vector space theory and matrix algebra, multivariate normal sampling theory, the theory of the multivariate general linear hypothesis including multivariate regression, MANOVA, and MANCOVA, and the theory of factor analysis. (Course will not be offered in 1981-82.)
451. *Linear Models*. II. (Alternate Years.) 3 hr. PR: Stat. 351, 362. Multivariate normal distribution, distribution of quadratic forms, linear models, general linear hypotheses, experimental design models, components of variance for random effects models.
490. *Teaching Practicum*. I, II. 1-3 hr. PR: Consent. Supervised practice in college teaching of statistics.
491. *Advanced Studies in Statistics*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced statistics subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
492. *Analysis of Experiments*. II. 1 hr. PR: Consent. Statistical consulting and data analysis.
496. *Graduate Seminar*. I, II. 1 hr. PR: Consent. It is anticipated that each graduate student will present at least one seminar to the assembled faculty and student body in statistics.
497. *Research in Statistics*. I, II, S. 1-15 hr. PR: Consent.

THEATRE

Jon Whitmore, *Chairperson of the Division*

307-A Creative Arts Center

Degree Offered: M.A.

Graduate Faculty: Members Neel, and Whitty; Associate Members Brindle, Gagliano, Murphy, and Whitmore.

Master of Arts (M.A.)

Admission. Prospective candidates for the degree of Master of Arts in Theatre (M.A.) must have an undergraduate degree in Theatre, an equivalent degree, or acceptable professional experience. Ordinarily, a minimum of 30 semester hours in Theatre at the undergraduate level is expected to have been completed with a grade-point average of no less than 2.75. Any deficiencies in undergraduate preparation must be completed, without credit, before the applicant is admitted as a regular graduate student in the program.

The applicant should be prepared to visit Morgantown for an interview with selected members of the faculty. Applicants intending to specialize in acting-directing should prepare an audition, and those intending to specialize in design-technical theatre should present a portfolio representative of past experience and training. For further details regarding this requirement, address inquiries to: Graduate Adviser, Division of Theatre, West Virginia University, Morgantown, WV 26506.

Fields of Specialization. Applicants should select a field of specialization in either: (1) Acting-Directing, (2) Design-Technical Theatre, (3) Puppetry, or (4) Playwriting.

Requirements. Successful completion of the minimum number of required graduate hours in one of the two following programs:

A. Thesis Program — (1) At least 30 semester hours of graduate credit, no more than 9 of which will be in research or thesis. Required courses are: Theat. 431; 460 (6 hr.); 400; 386; 362 or 375; 497 (6 hr.); 200-level courses (6 hr.); (2) Written comprehensive examinations in two areas: (a) the history, literature, and theory of the theatre; and (b) *either* acting and directing or design and technical theatre, puppetry, or playwriting. These examinations are administered late in the student's graduate program, and only if and when the student has a 3.0 grade-point average or 75 percent of the student's credit hours are of B grade or higher; (3) Submission for approval by the student's graduate committee of a thesis demonstrating original research and scholarly reporting; (4) An oral examination on the thesis.

B. Non-thesis Program — (1) At least 36 semester hours of graduate credit. Required courses are: Theat. 431; 460 (3-6 hr.); 400; 386; 362 or 375; 497 (6 hr.); 200-level courses (9-12 hr.); (2) Written and oral comprehensive examinations in two areas: (a) the history, literature, and theory of the theatre; and (b) *either* acting and directing or design and technical theatre. Either a 3.0 grade-point average or 75 percent of B grades for the hours carried is prerequisite to taking comprehensive examinations.

Doctor of Education (Ed.D.)

The degree of Doctor of Education (Ed.D.) is offered to a limited number of students in cooperation with the College of Human Resources and Education. Information regarding prerequisites to candidacy and requirements for the degree may be obtained from the Chairperson of the Division of Theatre.

Theatre (Theat.)

200. *Directed Theatre Studies*. I, II. 3-12 hr. (May be repeated for credit.) PR: Consent. Studies in theatre history, performance, stage design and technology, and theatre crafts. Subject matter and number of sections varies from semester to semester.
201. *Advanced Costume Construction*. I, II. 3 hr. (May be repeated for max. 6 hr. credit.) PR: Theat. 105. Study and practical application of costume construction through flat pattern, draping, and period pattern projects. Production assignments on theatre productions.
203. *Advanced Theatre Lighting Design*. I. 3 hr. PR: Theat. 103 or consent. Advanced theories of lighting and design for the stage. Practical experience with advanced lighting equipment.
205. *Advanced Technical Theatre*. I, II. 3 hr. (May be repeated for max. 6 hr. credit.) PR: Theat. 106, 107. Detailed study of scenery construction. Research projects, technical drawings, welding, properties construction, and study of new materials. Practical experience through work on productions.
206. *Stage Management*. I, II. 3 hr. PR: Theat. 106, 107, or consent. Detailed study of the role of the stage manager. Some stage management of Division of Theatre productions may be required.
240. *Music Theatre Workshop 1*. I. 3 hr. PR: Consent. Training in musical and dramatic performance through their joint application in contemporary musical theatre forms. (Open to voice music majors.)
241. *Music Theatre Workshop 2*. II. 3 hr. PR: Theat. 240. Continuation of Theat. 240, focusing on earlier stylized works. (Open to voice music majors.)
250. *Advanced Problems of Vocal Production*. I. (Alternate Years.) 3 hr. PR: Consent. Concentration on the voice and special problems of production, particularly vocal. Dialects and specific character vocal qualities.
251. *Vocal Production Performance*. II. (Alternate Years.) 3 hr. PR: Consent. The amalgamation and synthesis of all the vocal skills of performance incorporated in original theme productions.
260. *Theatre Performance and Rehearsal Laboratory*. I, II. 1-3 hr. (May be repeated for max. of 9 hr. credit.) PR: Theatre major and consent. Participation in assigned theatre projects. Appreciation of creativity and performance techniques in theatre.
262. *Scene Painting*. II. 3 hr. PR: Theat. 168 or consent. A study in the basic techniques used in preparing and painting scenery. Practical experience in painting scenery for theatre productions.
267. *Advanced Problems in Theatre Design*. I, II. 3 hr. (May be repeated for a max. of 12 hr. credit.) PR: Theat. 167, 168. A detailed study of costume and set design through in-depth design projects.
275. *Advanced Acting 1*. I. 3 hr. PR: Consent. Seeks to present advanced theories in acting to include script analysis, modern and historical, and to train the actor in advanced skills. Concentration upon broadening the actor's range.
276. *Advanced Acting 2*. II. 3 hr. PR: Consent. Extensive and intensive study of acting styles.
282. *Creative Dramatics*. I, II, S. 3 hr. PR: Theat. 75 or consent. Study and practice of creative dramatic activity as a method of learning and self development for children.
284. *Puppetry*. I, II. 3 hr. PR: Theat. 75 or consent. Comprehensive survey of construction and manipulation techniques of puppets. Evaluation of role of puppetry in child behavior and therapy techniques.

290. *Playwriting*. I, II. 3 hr. PR: Consent. Development of basic playwriting techniques. Specific assignments explore characterization, dramatic event, dialogue, tension, compression. Emphasis on the student finding his own voice, style, and courage to dramatize his view of the world.
291. *Advanced Playwriting*. II. 3 hr. PR: Theat. 290. Further exploration of dramatic technique, with emphasis on orchestrating the longer play. Also touches on script analysis of known dramatic texts and on practical problems of a playwriting career.
295. *Theatre History (Greeks to 1700)*. I. 3 hr. Examination of the major theatrical periods from the Greeks to the eighteenth century.
296. *Theatre History (1700 to the Present)*. II. 3 hr. PR: Theat. 295. Examination of the major theatrical periods from the eighteenth century to the modern day.
362. *Styles of Production Design*. I. 3 hr. PR: Theat. 295, 296, or consent. Extensive and intensive study of production styles in costume, lighting, and scene design.
375. *Styles of Directing*. II. 3 hr. PR: Consent. Methodologies in directing to include extensive and intensive study of directing styles.
386. *Drama Criticism and Aesthetics*. II. 3 hr. Survey of chief critical and aesthetic theories of theatre — ancient, modern, and contemporary.
400. *Applied Creative Performance*. 3 hr. (May be repeated for a max. credit up to 6 hr.) Creative projects and/or performance. Must have faculty approval as part of student's graduate program.
431. *Research Methods and Survey*. 3 hr. PR: Consent. Research methods and techniques and general survey of the field of theatre.
460. *Specialized Seminars*. 3-9 hr. (May be repeated for a max. credit of 9 hr.) PR: Consent. Selected fields of study in theatre.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Research*. I, II. 1-15 hr.
499. *Graduate Colloquium*. I, II, S. 1-6 hr. PR: Consent. For graduate students not seeking course work credit but who wish to meet residence requirements, use University facilities, and participate in its academic and cultural programs.

WILDLIFE MANAGEMENT

Jack E. Coster, Chairperson, Division of Forestry

322-A Percival Hall

Degree Offered: M.S.

Graduate Faculty: Members Hall, Michael, Samuel, and W. L. Smith. Associate Members Gill and Whitmore.

Master of Science

The Division of Forestry of the College of Agriculture and Forestry offers programs leading to the degree of Master of Science (M.S.) for students who wish to major in a forestry-related field (e.g., recreation, wildlife management) but do not wish to pursue the specific Master of Science in Forestry (M.S.F.) route. Applicants should have a bachelor's degree, with good academic performance and an appropriate background in the subject matter of the chosen field.

With the exception of those majoring in recreation, candidates must complete 30 credits of approved study, 6 of which shall constitute a thesis. Students majoring in recreation have the option of earning the degree on the basis of 30 hours without a thesis. These programs ordinarily require two years of residence.

Wildlife Management (W. Man.)

- 213. *Wildlife Ecology*. I. 4 hr. PR: Wildlife major or consent: Biol. 1 and 2. Basic principles of ecology and their application to wildlife. Field and laboratory studies of major ecosystems important to wildlife, including management of these ecosystems for wildlife.
- 222. *Field Ornithology*. S. 3 hr. PR: Biol. 2 or consent. Intensive field studies in recognition through sight, song, and behavioral patterns of birds, and their ecology in the central Appalachians.
- 224. *Forest Zoology*. I. 3 hr. PR: Biol. 2 or consent. Relationships of fish, amphibians, and reptiles to the forest, with emphasis on the ecology, taxonomy, evolution, natural history, and field identification of these groups. Laboratory emphasizes natural history and anatomy of fish, amphibians, and reptiles.
- 225. *Mammalogy*. II. 3 hr. PR: Biol. 2 or consent. Relationships of mammals to the forest, with emphasis on ecology, taxonomy, evolution, natural history, and anatomy of mammals. Laboratory emphasizes natural history and anatomy of mammals.
- 231. *Wildlife Techniques*. I. 3 hr. PR: Wildlife major or consent: W. Man. 213, Biol. 151. Field and laboratory techniques necessary in management and study of wildlife; collection of field data, mapping, censusing, habitat evaluation, literature and scientific writing.
- 234. *Principles of Wildlife Management*. II. 3 hr. PR: Wildlife major or consent; W. Man. 213. Major game animals and problems and principles involved in their management.
- 312. *Wildlife Population Ecology*. II. 3 hr. PR: W. Man. 131. Stat. 211, or equiv. Theory of population growth, population change, intraspecific and interspecific relationships involved in natural regulation of populations, and effects of exploitation on wildlife populations. (*Offered in Spring of even years.*)
- 333. *Quantitative Ecology*. I. 3 hr. PR: Stat. 311 or equiv., and W. Man. 213 or equiv. A survey of techniques and strategies for the quantitative analysis of complex ecological data sets. (*Offered in Fall of odd years.*)
- 370. *Wildlife Seminar*. I. 1 hr. per sem.: (4 hr. max.). PR: Consent. Discussion of current developments in wildlife management.
- 434. *Ecology and Management of Upland Wildlife*. I. 4 hr. PR: Consent. Ecology and management of upland game birds and mammals with emphasis on recent literature. (*Offered in Fall of even years.*)
- 436. *Ecology and Management of Wetland Wildlife*. II. 4 hr. PR: Consent. Ecology and management of waterfowl and wetland furbearers with emphasis on recent research and management literature. (*Offered in Spring of even years.*)

Part 5

OTHER GRADUATE COURSES AND FACILITIES

African Studies

Since 1967, West Virginia University has expanded its technical and academic competence regarding Africa from solely the agricultural sciences to include the social sciences and humanities. The colleges of Agriculture and Forestry, Arts and Sciences, Business and Economics, Engineering, Human Resources and Education, and the Creative Arts Center, are involved in teaching and research in African and Africa-related subjects.

The Committee on African Studies was organized in 1969, in cooperation with the WVU Office of International Programs, to fulfill two basic requirements: (1) to blend the agricultural expertise of long standing with the newer programs of study and research into unified course offerings and systematic research; and (2) to make available, to existing and prospective University programs of African technical assistance, knowledge in the social sciences and the arts. Moreover, it is within the committee's mandate to broaden its activities to include other parts of the world experiencing problems of development and human change similar to those of Africa. Although WVU programs have been related significantly to East Africa, they have a wider application. The concepts and philosophy developed in all of these activities can be utilized throughout Africa and, with suitable modification, could benefit other developing areas of the world, including the Appalachian region.

The Africana library collection contains approximately 7,000 volumes, exclusive of periodicals, and is capable of supporting undergraduate and graduate research up to and including the doctoral level within several natural and social sciences.

The committee does not offer undergraduate or graduate degrees in African studies as such, but rather stimulates, in students who are formally associated with departments in the natural and social sciences and the humanities, the interdisciplinary study of Africa and development.

In 1970, the graduate program in public administration was expanded to include an option in development administration. The effect of this is to ally the Committee on African Studies and its curriculum with the Department of Public Administration's M.P.A. Program. Students completing the option are awarded the M.P.A. degree with an interdisciplinary concentration in the area of African and development studies.

The committee provides opportunities for special nondegree study in Africa-related subjects and works to develop international study programs in Africa for University faculty and students.

Further information concerning the African Studies program may be obtained from: Rodger D. Yeager, Coordinator, Office of International Programs, 2112 Agricultural Sciences Building.

African and Related Graduate Courses of Study

COLLEGE OF ARTS AND SCIENCES

Department of English

Engl. 286 — Black American Fiction

Department of History

Hist. 227 — East Africa to 1895

Hist. 228 — East Africa Since 1895

Hist. 229 — History of Africa: Pre-Colonial

Hist. 230 — History of Africa: European Dominance to Independence

Hist. 251 — History of Black People in America to 1900

Hist. 252 — History of Black People in America Since 1900

Hist. 426 — Seminar in African History

Department of Political Science

Pol. S. 258 — Politics of Africa

Pol. S. 351 — Politics of Planned Development

Pol. S. 459 — Seminar in Comparative Government

Department of Sociology and Anthropology

Soc.&A. 240 — Social Change

Soc.&A. 241 — Population Dynamics

Soc.&A. 251 — Technology and Culture Change

Soc.&A. 290 — Special Topics

COLLEGE OF BUSINESS AND ECONOMICS

Econ. 213 — Economic Development

CREATIVE ARTS CENTER

Division of Music

Music 230 — Music of Africa

Agricultural Engineering

Agr. E.

280. *Agricultural Engineering Problems*. 1-3 hr. PR: Consent. Special problems relating to agricultural engineering.
491. *Advanced Study*. I, II, S. 1-6 hr. PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
497. *Research*. I, II, S. 1-15 hr.

Agricultural Mechanics

Ag. M.

253. *Advanced Farm Machinery*. I. 3 hr. Systems approach to selection, use, and operation of machinery as related to agriculture, forestry, and other rural activities. Emphasis on safety and environmental impact. Use of records for management decisions, purchase, replacement, sale or overhaul. 2 hr. rec., 3 hr. lab.

259. *Farm Structures*. II. 3 hr. Study of structures required for agriculture, family housing, storage, and recreation. Includes function, planning, layout, materials, construction techniques, prefabrication, repair, remodeling, and costs. 2 hr. rec., 3 hr. lab.
270. *Electricity in Agriculture*. II. 3 hr. Study of production and safe use of electricity for home and agriculture. Emphasis on approved wiring practices, motors, and electrical controls and their applications in lighting, heating, refrigeration, air conditioning, water supply, and processing. 2 hr. rec., 3 hr. lab.
275. *Agricultural Engines*. II. 3 hr. Study of power sources (gasoline, diesel, turbine, wankel, etc.) for agriculture and forestry. Operation, selection, maintenance techniques, and emissions impact on power and fuel efficiency. 2 hr. rec., 3 hr. lab.
352. *Advanced Farm Mechanics*. S. 3 hr. PR: Ag. M. 152. Development of advanced skills with hand and power tools. Areas of emphasis dependent upon needs of individual students. Care and maintenance of power tools and shop organization and planning are essential parts of this course. 1 hr. rec., 6 hr. lab. (*Offered Summer of every third year — next offering 1981.*)

Conjoined Basic Sciences Courses

In the curricula of the School of Medicine, certain courses are conducted on nondepartmental or interdepartmental lines. These have been designed as Conjoined Courses.

CC MD

320. *Electron Microscopy*. II. 2-4 hr. PR: Consent. (For graduate students, upperclass students in the sciences, medical students.) Interdisciplinary. Introduction to cell fine structure and function. Preparation of biological specimens for electron microscopy.
350. *Radiation Safety and Isotope Usage*. II. 1-2 hr. PR: Phys. 1 and 2, Chem. 15 and 16 or consent. Chemical, physical, and biological aspects of radiation; safety; handling and storage of radioactive materials; ERDA (formerly AEC) and WVU regulations and licensing; detection and instrumentation, research, and clinical use of radiosotopes.
370. *Medical Genetics*. (For medical and limited number of graduate students.) II. 1 hr. PR: Consent. Genetics and heritable diseases in man.
375. *Neurobiology*. (For medical and limited number of graduate students.) II. 6 hr. PR: Anat. 301 and Physi. 345, or consent. Anatomy and physiology of the nervous system correlated with clinical neurology.
399. *Selective Experiences in Medicine*. (*Fourth Year.*) I, II, S. CR. PR: Satisfactory completion of the first three years of medical curriculum. (Graded as S or U.) The selective program for fourth-year medical students offers a wide range of opportunities in the basic sciences, medical specialties and sub-specialties, and in family medicine. The year is composed of eleven 4-week blocks. Six must be spent at the WVU Medical Center in Morgantown and approved programs at the Charleston Division, WVU Medical Center; the Wheeling Division, School of Medicine; and the Veterans Administration Hospital, Clarksburg. The remainder may be spent at community hospitals in West Virginia, or at university or university-affiliated hospitals out-of-state. Each student plans the individual program, with faculty advice. Flexibility is permitted. With consent of the instructors concerned, the student may, during the year, alter the selective choices. The student must give five weeks' notice before changing an intramural or extramural selection. (See intramural and extramural folders, published annually, that describe the selected opportunities.)

Energy Research Center

The Energy Research Center was established at WVU to lead, coordinate, and stimulate research in the coal and energy areas. The center will utilize and integrate the resources of the faculty and students in a broad range of academic disciplines to address energy-related concerns of a national, regional, and state nature. By not being aligned with any academic unit, the center is inherently interdisciplinary and enhances the development of coal and energy research across traditional academic boundaries.

All center activities are carried out by the University's teaching faculty and selected graduate students from a variety of academic disciplines. This group constitutes a pool of highly skilled researchers who can respond to diverse energy-related problems and who add to the University's instructional mission through the duality of their teacher/research roles.

Research projects are grouped around several broad areas of research. Each area is assigned a faculty member for coordination. Each project is managed by the faculty member conducting the research.

Students interested in participating in energy research projects should contact the department chairperson in that field.

Further information about the WVU Energy Research Center may be obtained from Prof. M. Dayne Aldridge, Director, Energy Research Center, 258 Stewart St.

Mining and Mineral Resources Research Institute

West Virginia University has been designated by the federal government as one of twenty-two institutes dedicated to research and training of advanced students in mining and mineral resources area. The WVU program focuses on researching problems associated with the surface effects of mining in West Virginia and the Appalachian region. Managed by the Energy Research Center, this program provides opportunities for WVU faculty to receive support for research projects involving students, and to nominate outstanding students for scholarships and fellowships.

National Small Wastewater Flows Clearinghouse

The Energy Research Center was selected to develop and operate the National Small Wastewater Flows Clearinghouse for the Environmental Protection Agency (EPA). This program collects and disseminates reports and information relating to small wastewater flows sewage systems. Professors and students analyze and abstract information and prepare material for publication.

General Engineering

Eng.

260. *Assessment of Energy Systems*. 3 hr. A comparative study of energy systems for use in meeting the energy demands of the nation. Conversion processes for utilizing fossil fuel, nuclear, geothermal, and solar sources for supplying clean fuels and energy.

Gerontology Center

The West Virginia University Gerontology Center was created in July, 1978, to highlight WVU's commitment to improve the quality of life for elderly persons. Because WVU is located in Appalachia, a major thrust of the center is concern for the rural elderly. The Gerontology Center is dedicated to stimulating, facilitating, and coordinating interdisciplinary teaching, research, and service in gerontology at WVU.

The College of Arts and Sciences, College of Human Resources, School of Physical Education, School of Social Work, College of Agriculture and Forestry, School of Medicine, School of Nursing, and the Center for Extension and Continuing Education are involved in teaching and research in gerontology and aging-related subject areas.

Planning is underway to develop certification programs in gerontology at WVU. Such programs would enable students to obtain specialized knowledge in gerontology to prepare them for employment or research in the field of aging.

Further information about interdisciplinary studies in gerontology may be obtained from Nancy Datan, Acting Director, WVU Gerontology Center, Knapp Hall.

Landscape Architecture

L. Arc.

- 229. *Landscape Architecture*. I. 3 hr. (For non-majors only.) An appreciation of basic principles of design and information pertaining to use and care of ornamental plants around the house.
- 248. *Design Analysis*. II. 2 hr. PR: Consent. Analysis of planning and design projects with respect to offering solutions to a given problem. (*Offered in Spring of odd years.*)
- 250. *Advanced Landscape Architectural Design 1*. I. 6 hr. PR: L. Arc. 132 and 151. Advanced landscape design of semipublic and public areas involving comprehensive problems and in-depth individual and team study.
- 251. *Advanced Landscape Architectural Design 2*. II. 6 hr. PR: L. Arc. 250. Continuation of L. Arc. 250, culminating in a comprehensive final design project.
- 265. *Regional Design*. II. 3 hr. PR: Consent. Consideration of regional landscapes in order to effectively relate design to the ecology and development of a region. (*Offered in Spring of odd years.*)
- 276. *Recreation Planning*. I, II. 3 hr. PR: Consent. (I — L. Arc. majors only; II — non-majors only.) Design of park and recreation areas involving park history, classification theory, and administration.
- 284. *Professional Practice*. II. 3 hr. PR: Consent. Procedures in preparation of contract documents, fees, estimates, operation of an office, and relationship to clients and contractors.

Library Science

Library Science courses can be a part of many graduate programs as electives in some and as a field of study in others.

The courses are designed for:

1. Elementary or secondary school teachers who wish to meet the certification requirements for school library media specialists in West Virginia and other states.

2. Certified teachers and school librarians desiring further development in the field of library science.

3. Administrators who wish to broaden their knowledge and training in the field of school library media.

4. Graduate students in other fields desiring electives in library science.

In addition, the department offers courses designed to give students a working knowledge of the major information sources in specific areas and to help them in using the library effectively.

Students pursuing a Master of Arts degree in Education with a field in Library Science must take 12 hours in Education, 12 hours in Library Science, and 12 additional hours in Library Science, Education, or a related field for a total of 36 hours. Consult the Department of Library Science for specific course requirements. Comprehensive examinations are required in both Education and Library Science.

L. Sci.

- 201.* *Reference and Bibliography*. 3 hr. Basic reference books, dictionaries, encyclopedias, indexes, yearbooks, and other reference materials are studied and evaluated, with emphasis on the theory of and practical experience with reference books for print and non-print materials. (Course will not be offered in 1981-82.)
- 203.* *Literature for Children*. I, II. 3 hr. A survey of children's literature including its historical development as well as current trends. Emphasizes selection, critical evaluation, and utilization of literary materials for developmental, recreational, and curriculum needs. Appropriate media included.
- 205.* *Selection of Books and Related Materials for the Secondary School Library*. I. 3 hr. Survey of adolescent literature and other library materials adapted to the needs of junior and high school students.
- 222.* *Field Practice*. I, II. 3 hr. PR: L. Sci. 201, 203, 205, 223, 250. Practical experience in a variety of public, school, and special libraries, and instructional materials centers, under the supervision of experienced librarians and media specialists. Student must complete 100 clock hours.
- 223.* *Cataloging and Classification*. II. 3 hr. Basic principles and problems of cataloging and classification combined with practical experience in processing the various types of books and materials. Problems peculiar to the teacher-librarian considered.
- 250.* *Managing School Library Media Centers*. II. 3 hr. PR: L. Sci. 201, 203, 205, 223; Ed. P. 260, or consent. Covers the planning, organization, and operation of a school library media center. Includes staffing, budgeting, scheduling, public relations, and program design. Stresses the role of the media center in the total educational process.

*Presently required for certification in West Virginia.

291. *Advanced Study*. I, II, S. 3 hr. (May be repeated for credit only when the content of the course is different.) Study of current topics related to informational resources or the school media center. A final project will be required.
326. *Bibliography of the Social Sciences*. I. 1 hr. Covers bibliographic structure and information sources in psychology, sociology, political science, economics, history, education and related disciplines. Provides a good working knowledge of information retrieval tools and the ability to use libraries effectively.
410. *Special Topics*. I, II, S. 3 hr. A thorough study of some phase of library science based on the needs and interest of the individual.

Pathology

Research Areas — Atherosclerosis; thrombosis; platelet aggregation and function; lipid and lipoprotein metabolism in cultured human endothelial cells; morphometric (including electronmicroscopic) and biochemical studies on the progression of atherosclerotic lesions in humans; regression of experimental atherosclerotic lesions; ultrastructural aspects of renal disease; ultrastructural reflections of dedifferentiation in neoplasia; biomedical application of laboratory medicine; applied laboratory studies in microbiology.

Path.

128. *Introduction to General Pathology*. I. 2 hr. PR: Enrollment in dental hygiene or physical therapy. A study of the basic pathologic processes in man.
129. *Oral Pathology*. II. 3 hr. PR: Path. 128, dental hygiene major, or consent. Application of fundamental knowledge of general pathology to pathological conditions that occur in the oral cavity.
328. *General Pathology*. (For dental students and certain graduate students with consent of chairperson.) I. 5 hr. PR: Anat. 309. General changes in basic pathologic processes and changes evoked in specific organ systems as a basis for understanding clinical disease.
350. *Hematology*. 3 hr. PR: Consent.
351. *Pathology and Laboratory Medicine*. (For medical students and limited number of regular full-time graduate students in basic medical sciences and consent of the chairperson.) I, II. 15 hr. PR: Medicine I Curriculum. Presents pathology as a body of knowledge and a discipline, including laboratory aspects of disease. General pathology, including cell injury, inflammation, neoplasia, thrombosis and circulatory disturbances, is followed by a systemic approach to disease states.
353. *Oral Pathology II*. I. 2 hr. PR: Path. 338; consent. Continuation of Path. 338.
355. *Clinico-Pathologic Correlation Conference*. (For dental students, third year.) II. 1 hr. PR: Path. 338, 353; consent. Interesting clinical cases are demonstrated grossly, radiographically, and histologically. Diagnosis is established and treatment discussed.
356. *Advanced Pathology*. I, II. 3 hr. PR: Path. 328 and 354; consent. Microscopic and gross specimens from selected autopsies.
382. *Advanced Oral Histopathology*. I, II. 1-2 hr. PR: Path. 338, 353; consent. Microscopic study of head and neck lesions.

Philosophy

Phil.

253. *Philosophy of Mathematics*. I or II. 3 hr. PR: Phil. 106 or consent. Contemporary viewpoints in the foundations of mathematics.
272. *Philosophy of Law*. I or II. 3 hr. PR: 6 hr. in philosophy or law or pre-law student or consent. A philosophical, metatheoretical study of legal theorizing, a metaphysical investigation of the presuppositions of legal claims and an application of philosophical ethics to legal practices, concentrating on recent studies by philosophical analysts.
283. *Philosophy of History*. I or II. 3 hr. PR: 6 hr. in philosophy or history major or consent. Theoretical problems such as the nature of historical explanation, relativism, and the status of speculative principles of history. (*Course will not be offered in 1981-82.*)
285. *Philosophy of Language*. I or II. 3 hr. PR: 6 hr. in philosophy or linguistic or language major or consent. Philosophical problems concerning the nature of meaning and language.
290. *Directed Studies*. I, II, S. 1-6 hr. (May be repeated.) PR: Instructor's written consent. Individually supervised research and projects.
292. *Advanced Topics in Philosophy*. I or II. 3 hr. PR: 6 hr. in philosophy or consent. Advanced philosophical investigation of selected problems and issues. Topics will vary.
302. *Philosophy of Science*. I or II. 3 hr. Philosophical problems associated with the concepts and methodology of science.
303. *Theory of Knowledge*. I or II. 3 hr. Definitions of knowledge, truth, and belief. Problems associated with skepticism of induction, perception, introspection, memory and a priori knowledge.
304. *Smybolic Logic*. I or II. 3 hr. The logic of statements, relations and identity; introduction to the notions of consistency, completeness, and decidability.
305. *History of Philosophy*. I or II. 3-9 hr. Selected topics in the history of Western philosophy, usually with concentration on one of the following periods: ancient, medieval, modern, or recent.
306. *Metaphysics*. I or II. 3 hr. Traditional problems associated with universals and particulars, reality and experience, causality, space and time, matter and mind, the nature of the self, etc. (*Course will not be offered in 1981-82.*)
310. *Ethics*. I or II. 3 hr. An examination of selected theoretical and applied problems in the field of professional ethics.
313. *Advanced Philosophy of the Social Sciences*. I or II. 3 hr. PR: Consent. Philosophical problems associated with the concepts and methodology of the social sciences.
321. *Seminar: Selected Topics*. 3-9 hr.
497. *Research*. 1-15 hr.
401. *Special Studies in Oral Pathology*. I, II. 1-3 hr. PR: Consent. Advanced seminar of independent study of local and/or systemic disease processes affecting oral and facial structures.
497. *Research*. I, II. 1-15 hr. PR: Consent.

Religious Studies

Relig.

290. *Seminar: Selected Topic. I or II.* 3 hr. PR: A previous Religious Studies course or consent.
291. *Seminar: Selected Topic. I or II.* 3 hr. PR: A previous Religious Studies course or consent.

Harley O. Staggers National Transportation Center

In 1979, the U.S. Secretary of Transportation designated the first National Transportation Center at West Virginia University and recommended naming it for former Congressman Harley O. Staggers of West Virginia in recognition of his promotion of new and improved transportation systems.

Improving rural transportation and automated guideway technology, taking advantage of WVU's experimental Personal Rapid Transit System as a laboratory, are the initial focuses of the Center, which is a multidisciplinary program.



Part 6

FINANCIAL INFORMATION

Fees and Expenses

All West Virginia University fees are subject to change without notice.

A nonrefundable special service fee of \$15.00 must accompany the application for admission to the Graduate School.

All fees are due and payable to the Controller on the days of registration. Medical Center students pay their fees at the Controller's Office, Basic Sciences Building. Students must pay fees before registration is accepted.

Completion of arrangements with the Controller's Office for payment from officially accepted scholarships, load funds, grants, or contracts shall be considered sufficient for acceptance of registration. Fees paid after regular registration must be paid to the University Cashier in Mountainlair. Medical Center students pay at the Controller's Office, Basic Sciences Building.

Any student failing to complete registration on regular registration days is subject to the Late Registration Fee of \$10.00.

Students registering pay the fees shown in the fees charts, plus special fees and deposits as required.

No degree will be conferred upon any candidate and no transcripts will be issued to any student before payment is made of all tuition, fees, and other indebtedness to any unit of the University.

Persons not registered as University students and who are not members of its administrative or teaching staffs shall not be admitted to regular attendance in University classes.

Fees for Off-Campus Courses

Fees for credit hours for off-campus students are the same as those charged students enrolled in on-campus courses. Off-campus students do not pay the Daily Athenaeum Fee, the Radio Station Fee, or the Mountainlair Construction Fee. However, all students must pay a \$20.00 course fee for each off-campus course taken.

Laboratory Fees

Consult specific departmental sections of this *Catalog* concerning nonrefundable deposits and microscope rental fee.

Music Practice and Rental Fees

Practice Room Fee. All Music majors must pay a fee of \$10.00 per semester, which entitles them to assigned practice space one hour per day. Additional space may be available at the rate of \$4.00 per hour.

Band and Orchestra Instruments. Rental, \$10.00 per semester.

Special Fees

Application for Admission (College of Law and Graduate School)	\$15.00
Certificate of Advanced Study in Education	2.00
Diploma Replacement	5.00
Examination for Advanced Standing	3.00
Examination for Entrance Credit, per unit	1.00
Examination of Candidate for Graduate Degree	1.00
(For graduate students not otherwise enrolled at time of final examination)	
General Educational Development Tests (high school level)	15.00
(If the applicant applies for admission to and registers in WVU within twelve months of the date of qualifying for the test, a \$10.00 credit shall be established for the applicant.)	
Graduate Program Continuance Fee	35.00
Graduation	10.00
(Payable by all students at the beginning of the semester or session in which they expect to receive their degrees.)	
Late Registration (nonrefundable)	10.00
(Not charged to students who complete registration during the regular registration days set forth in the University Calendar.)	
Professional Engineering Degree (includes \$10.00 Graduation Fee)	25.00
Reinstatement of Student Dropped from the Rolls	3.00
Student Identification Card Replacement	1.00
Student's Record Fee	2.00
(One transcript of a student's record is furnished by the Dean of Admissions and Records without charge. This fee is charged for furnishing an additional transcript.)	

Summer Fees

Tuition, per semester hour	Resident	Nonresident
Undergraduate students	\$11.00	\$54.00
Professional and Graduate students	16.00	73.00
Dentistry and Medicine students	22.00	82.00
Daily Athenaeum Fee*90	.90
Radio Station Fee*90	.90
Health, Counseling, and Program Services Fee	13.50	13.50
Mountainlair Construction Fee per 6-week summer session or any portion thereof*	7.50	7.50
Student Affairs Fee	5.70	5.70
Transportation Fee	9.50	9.50

*Fee required of all students. (Nonrefundable unless student withdraws officially before the close of general registration.)

Semester Fees in Colleges and Schools

(Subject to Change Without Notice.)

FULL-TIME¹

UNDERGRADUATE^{a, f}

	Tuition	Registration	Higher Education Resources	Institutional Activity	Mountainlair Construction	TOTAL
Resident	\$ 40.00	\$ 50.00	\$ 35.00	\$101.00 ^e	\$20.00	\$246.00
Nonresident	205.00	250.00	180.00	\$101.00 ^e	20.00	756.00

PROFESSIONAL AND GRADUATE^{b, f}

Resident	\$ 55.00	\$ 50.00	\$ 35.00 ^c	\$101.00 ^e	\$20.00	\$261.00
Nonresident	230.00	250.00	180.00 ^c	\$101.00 ^e	20.00	781.00

DENTISTRY AND MEDICINE^f

Resident	\$117.00	\$ 50.00	Not Applicable ^d	\$101.00 ^e	\$20.00	\$288.00
Nonresident	335.00	250.00	Not Applicable ^d	\$101.00 ^e	20.00	706.00

^aUndergraduate students enrolled for 12 or more credit hours pay maximum charges as indicated. Students enrolled for less than 12 credit hours pay a pro-rated charge calculated in direct proportion to the number of credit hours taken.

^bProfessional and graduate students enrolled for 9 or more credit hours pay maximum charges as indicated. Students enrolled for less than 9 credit hours pay a pro-rated charge calculated in direct proportion to the number of credit hours taken.

^c"Professional and Graduate," for fee purposes, includes all programs in the Medical Center, except Dentistry, Medicine, and Pharmacy; all programs in the Graduate School, and in the College of Law.

^dPaid by Law and Graduate students only. Others pay appropriate laboratory and microscope fees.

^eDental and Medical students pay appropriate laboratory and microscope fees.

^fIncludes Athletics Fee, \$20.00; Student Affairs Fee, \$15.00; Daily Athenaeum Fee, \$2.50; Health, Counseling, and Program Services Fee, \$36.00; Transportation Fee, \$25.00; Radio Station Fee, \$2.50.

^gAll part-time students enrolled for 7 or more credit hours must pay the Institutional Activity and Mountainlair Construction Fee.

PART-TIME²

Tuition per semester hour	Resident	Nonresident
Undergraduate Students	\$11.00	\$54.00
Professional and Graduate Students	16.00	73.00
Dentistry and Medicine Students	22.00	82.00

The minimum rate for noncredit courses is that charged for one semester hour of credit.

¹A full-time professional or graduate student is one who is registered for 9 or more semester hours of work each semester of the regular academic year, or 6 or more semester hours of work during the summer.

²A full-time undergraduate student is one who is registered for 12 or more semester hours work each semester of the regular academic year, or 6 or more semester hours of work during a 6-week summer session.

³For fee assessment purposes, a part-time professional or graduate student is one who is registered for fewer than 9 semester hours per semester during the regular academic year, or for fewer than 6 semester hours during a 6-week summer session.

⁴A part-time undergraduate student is one who is registered for fewer than 12 semester hours per semester during the regular academic year, or for fewer than 6 semester hours during a 6-week summer session.

Auditors

Students may enroll in courses without working for grade or for credit by registering as auditors and by paying full fees. Change in status from audit to credit or from credit to audit may be made during the registration period. Attendance requirements for auditors shall be determined by the instructor of the course being audited. It is the prerogative of the instructor to strike the name of any auditor from grade report forms and to instruct the Office of Admissions and Records to withdraw the auditor from the class, if attendance requirements are not met.

Remission of Fees

The tuition fee and registration fee will be remitted to a person registered in the Graduate School or the College of Law and who is employed by the University on a regular appointment, subject to the following:

(a) There will be no remission of the Daily Athenaeum Fee, the Mountainlair Construction Fee, or the Radio Station Fee. These fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction.

(b) Except as provided in (c), a graduate teaching or graduate research assistant will receive remission of tuition fee and registration fee commensurate with the hours of service required by the terms of the assistant's appointment.

(c) A faculty member on full-time appointment at any recognized institution of higher learning in West Virginia who is taking a course of graduate study at WVU and holds an appointment as a graduate assistant will receive full remission of tuition and registration fees.

(d) A regular appointment must be effective at the beginning of a semester or summer session. Exemption from tuition fee and registration fee must be claimed at the beginning of the registration period or, in the case of a substitute appointment, within ten days after the appointment has been made.

(e) An employee who holds a regular appointment and is eligible for remission of tuition fee and registration fee in the second semester of any regular academic year also is eligible for remission of tuition fee and registration fee in the summer session immediately following the student's term of appointment.

In certain cases an employee on regular University appointment may be permitted to register as a full-time student in the Graduate School or the College of Law. If such an employee does register as a full-time student and qualifies for remission of tuition fee and registration fee, the employee shall not be subject to the Special Services fees, except the Daily Athenaeum Fee, the Mountainlair Construction Fee, and the Radio Station Fee, but must pay such fees to be entitled to the services provided thereby. Such employees do not receive the student identification card which provides for athletic admissions, student educational services, and health, counseling, and program services, etc.

Refund of Fees

A student who officially withdraws from University courses may arrange for a refund of fees by submitting to the University Controller evidence of eligibility for a refund.

To withdraw officially, a student must obtain a withdrawal form from the Division of Student Affairs for permission. Semester fees will be returned in accordance with the following schedule:

First refund period ending on the twelfth day following the beginning of General Registration	} All activity fees chargeable to Special Services and all other semester fees less \$2.50. (Under no circumstances is the amount retained less than \$2.50.)
Second refund period ending on the fifth Friday following the beginning of General Registration	
Last refund period ending on the eighth Friday following the beginning of General Registration	} 70% of all refundable fees
	} 40% of all refundable fees

The second Friday following the beginning of general registration for the summer session or a summer term is the end of the refund period.

No part of the Activity Fee is refundable unless the student withdraws from the University.

University policy provides that students called to the armed services of the United States may be granted full refund of refundable fees, but no credit, if the call comes before the end of the first three-fourths of the semester, and that full credit of courses be granted to persons called to the armed services of the United States if the call comes thereafter; provided, however, that credit as described above will be granted only in those courses in which the student is maintaining a passing mark at the time of departure for military service. In the recording of final grades, for three-fourths of a semester or more, both passing and failing grades are to be shown on the student's permanent record.

Service Charge on Returned Checks

A service charge of 5 percent of the amount of each check returned unpaid by the bank upon which it is drawn shall be collected unless the student can obtain an admission of error from the bank.

If the check returned by the bank was in payment of University and registration fees, the Controller's Office shall declare the fees unpaid and registration cancelled if the check has not been redeemed within three days from date of written notice. In such a case the student may be reinstated upon redemption of the check, payment of the 5 percent service charge, Reinstatement Fee of \$3.00, and Late Payment Fee of \$10.00.

Cost of an Academic Year's Work

For graduate students, the Financial Aid Office estimates that the total cost of attending WVU for a nine-month academic year is \$4,125 for single West Virginia residents living on or off-campus and \$2,875 for those living at home; \$5,125 for single nonresidents living on or off-campus and \$4,125 for those living at home.

These typical student budgets include tuition and fees, books and supplies, room, board, transportation, and personal expenses that provide for a modest but adequate life-style.

Residential Status

The West Virginia Board of Regents has adopted regulations governing the classification of students as residents or nonresidents for admission and fee purposes at all institutions under its jurisdiction.

General — Students enrolling in WVU shall be classified as resident or nonresident for admission, tuition, and fee purposes by the Dean of Admissions and Records. The decision shall be based upon information furnished by the student and all other relevant information. The Dean of Admissions and Records is authorized to require such written documents, affidavits, verifications, or other evidence as are deemed necessary to establish the domicile of a student. The burden of establishing residency for tuition and fee purposes is upon the student.

If there is a question as to residence, the matter must be brought to the attention of the Dean of Admissions and Records and passed upon at least two weeks before registration and payment of tuition and fees. Any student found to have made a false or misleading statement concerning the student's residence shall be subject to disciplinary action and will be charged the nonresident fees for each session theretofore attended.

Residence Determined by Domicile — Domicile within the state means adoption of the state as a fixed permanent home and involves personal presence within the state with no intent on the part of the person to return to another state or country. West Virginia domicile may be established upon the completion of at least twelve months of continued residence within the state before the date of registration, provided that such twelve months residency is not primarily for the purpose of attendance at any institution of learning in West Virginia.

Establishment of West Virginia domicile with less than twelve months residence before the date of registration must be supported by proof of positive and unequivocal action, such as, but not limited to, the purchase of a West Virginia home, full-time employment within the state, paying West Virginia property tax, filing West Virginia income tax returns, registering to vote in West Virginia and the actual exercise of such right, registering of motor vehicles in West Virginia, and possessing a valid West Virginia driver's license. Additional items of lesser importance include transferring or establishing local church membership, involvement in local community activities, affiliation with local social, civic, fraternal, or service organizations, and various other acts which may give evidence of intent to remain indefinitely within the state. Proof of a number of these actions shall be considered only as evidence which may be used in determining whether or not a domicile has been established.

Minors — Minors are defined by the West Virginia Code (2-2-10) as persons under 18 years of age. The residence of a minor shall follow that of the parents at all times, except in extremely rare cases where emancipation can be proved beyond question. The residence of the father, or the residence of the mother if the father is deceased, is the residence of the unmarried or unemancipated minor. If the father and the mother have separate places of residence, the minor takes the residence of the parent with whom the minor lives or to whom the minor has been assigned by court order. The parents of a minor will be considered residents of West Virginia if their domicile is within the state.

A minor student who is properly admitted to an institution as a resident student shall retain that classification as long as the student enrolls each successive semester.

Emancipated Minor — An emancipated minor may be considered as an adult in determining residence, provided satisfactory evidence is presented that

neither of the parents, if living, contribute to the minor's support nor claim the minor as a dependent for federal or state income tax purposes.

In the event that the fact of emancipation is established, the emancipated minor assumes all of the responsibilities of an adult to establish residence for tuition and fee purposes. Proof must be provided that emancipation was not achieved principally for the purpose of establishing residence for attendance at an institution of higher education.

Students 18 Years of Age or Over — A student 18 years of age or over may be classified as a resident if: (1) the parents were domiciled in the state at the time the student reached majority and such student has not acquired a domicile in another state, or (2) while an adult the student has established a bona fide domicile in West Virginia. Bona fide domicile in West Virginia means that the student must not be in the state primarily to attend an educational institution and the student must be in the state for purposes other than to attempt to qualify for resident status.

Any nonresident student who reaches the age of 18 years while a student at any educational institution in West Virginia does not by virtue of such fact alone attain residence in this state for admission or tuition and fee payment purposes.

A student who is properly classified as a resident at the time of attaining the age of 18 shall continue to be classified as a resident as long as the student enrolls each successive semester and does not establish a domicile, or legal residence, in another state.

Change of Residence — An adult student who has been classified as an out-of-state resident and who seeks resident status in West Virginia must assume the burden of proving conclusively that the student has established domicile in West Virginia with the intention of making the student's permanent home in this state. The intent to remain indefinitely in West Virginia is evidenced not only by a person's statements but also by a person's actions. The Dean of Admissions and Records in making his determination shall consider such actions as, but not limited to, the purchase of a West Virginia home, full-time employment within the state, paying West Virginia property tax, filing West Virginia income tax returns, registering to vote in West Virginia and the actual exercise of such right, registering of motor vehicles in West Virginia, and possessing a valid West Virginia driver's license. Additional items of lesser importance include transferring or establishing local church membership, involvement in local community activities, affiliation with local social, civic, fraternal, or service organizations, and various other acts which may give evidence of intent to remain indefinitely within the state. Proof of a number of these actions shall be considered only as evidence which may be used in determining whether or not a domicile has been established. Factors militating against a change in residence classification may include such considerations as the fact that the student is not self-supporting, that the student is carried as a dependent on the parents' federal or state income tax returns or the parents' health insurance policy, and that the student customarily does not remain in the state when school is not in session.

Marriage — The residence of a married person is determined by the same rules of domicile which would apply if he or she were not married.

Military — An individual who is on active military service or an employee of the federal government may be classified as a resident for the purpose of payment of tuition and fees provided the individual established a domicile in West Virginia before entrance into federal service, that the individual entered the

federal service from West Virginia, and that the individual has at no time while in federal service claimed, or established, a domicile in another state. Sworn statements attesting to these conditions may be required. The spouse and dependent children of such individuals also shall be classified as residents of the state of West Virginia for tuition and fee purposes. Persons assigned to full-time active military service and residing in West Virginia may be classified as in-state residents for tuition and fee purposes after twelve months of continuous location in the state.

Aliens — An alien in the United States on a resident visa, or who has filed a petition for naturalization in the naturalization court, and who has established a bona fide domicile in West Virginia, may be eligible for resident classification, provided the alien is in the state for purposes other than to attempt to qualify for residency status as a student.

Appeal Process — The decisions of the Dean of Admissions and Records may be appealed to the President of WVU. The President may establish such committees and procedures as he determines necessary for the processing of appeals. The decision of the President may be appealed in writing with supporting documentation to the West Virginia Board of Regents in accord with such procedures as may be prescribed from time to time by the Board of Regents.

WVU Assistantships, Fellowships, and Traineeships

West Virginia University annually awards over 500 graduate assistantships supported from state appropriations, federal funds, private grants, and contracts; and about 200 fellowships and traineeships derived from federal programs such as HEW, NIH, NSF, VA, etc., and from industries and private foundations. The awards are made in degree programs, and application must be initiated in the unit administering the program.

Fellowships are awarded on the basis of academic merit and require no service in return. A graduate fellow is expected to spend full time in pursuit of studies, but may teach to the extent that the particular degree program requires. Most traineeships, provided for by institutional grants, are also for full-time study without scheduled research duty. For assistantships, stipends are generally stated in terms of 9- or 12-month appointments for (1) 20 hours of service per week in the case of research assistantships, or (2) the assisting with instruction of two courses or the equivalent in the case of teaching assistantships.

Tuition and registration fees are generally remitted. Departments and research units may occasionally make appointments for more or for less service with proportionately adjusted compensation. In the latter case, the remission of tuition and registration fees also is reduced proportionately. Assistants are permitted to take no more than 12 credit hours in any one semester, and some college, school, and department regulations may be more strict in this regard.

Applications should be made by the first week of February to the dean of the college or school concerned or to the chairperson of the program in which the graduate work will be pursued.

Remission of Fees

Graduate assistants, fellows, and trainees the conditions of whose stipends include remission of tuition and registration fees are also entitled to remission of the Higher Education Resources fee. Like all students they must pay the

Mountainlair Construction, Radio Station, and Daily Athenaeum fees, but with regard to the rest of the Institutional Activity fee they are granted the same option as are part-time students.

Claude Worthington Benedum Foundation and WVU Foundation Doctoral Fellowships

Michael L. Benedum has been a special benefactor to WVU through his establishment of the Claude Worthington Benedum Foundation, named in memory of his son. Through a challenge grant from this foundation and a generous response from the WVU Foundation, Inc., the Graduate School is able to offer Claude Worthington Benedum Fellowships and WVU Foundation Doctoral Fellowships.

These three-year fellowships are awarded to doctoral students who have displayed previous evidence of scholarship and of dedication to academic, artistic, and investigative pursuits. Yearly stipends are \$4,000 for full-time, full-year enrollment (12 months) or prorated at \$333 per month for lesser periods. These fellowships are competitive, and selection is based on previous academic performance, letters of reference, Graduate Record Examination or other standardized achievement examination, and the applicant's statement of professional goals. Candidates must be nominated by the faculty of the proposed doctoral program no later than mid-February. (Inquire of the Graduate School office for the specific date.)

Academic Advising Center

Assistantships are available through the Academic Advising Center for students who have been admitted to a graduate program. Those who are accepted will provide academic advising services to freshman and sophomore students in Arts and Sciences. Stipends are paid at the same rate as those for departmental awards in the College of Arts and Sciences and require half-time service. Tuition and registration fees are also waived. Contact Assistant Dean, 104 Student Services Center. Applications must be filed before February 1.

Resident Assistantships

Approximately fifty positions are available for single graduate students to serve as resident assistants in the University residence halls. Selection is based on the applicant's academic record, previous background and experience, and interpersonal relationship skills.

Resident assistants serve as members of the staff of Student Educational Services advising approximately fifty freshman students on floors in University residence halls. These positions provide room and board and a small cash stipend.

Applications are available in February and nine-month appointments are made in April for the following academic year.

For further information and application write to the Director of Housing and Residence Life, G18-A Towers, West Virginia University, Morgantown, WV 26506.

Stipend Payment Dates for Trainees and Fellows

The start of entitlement periods under these awards is usually September 1 of each year. Invoices for payments are prepared in the Graduate School office each month between the 10th and 15th for entitlements earned during that month. Checks are normally available at the Graduate School office for the students on the first day of the next month. Students who will receive stipends under these programs must arrange their finances accordingly for their needs from the beginning of the First Semester to October 1.

Financial Aid: Loans, Employment

Information and guidance on loans for graduate students are available in the Financial Aid Office, Mountainlair.

On-campus employment opportunities can be investigated at the Financial Aid Office in Mountainlair and the Personnel Office in Knapp Hall.

Fellowship Opportunities for Study In the United States or Abroad

Fulbright-Hays Grants for Study Abroad

These grants are provided under the Mutual Educational Exchange (Fulbright-Hays) Program and by other donors for study in any of more than forty countries. Most of these one-year awards go to advanced graduate students who will engage in dissertation research, although some are open to seniors and master's candidates.

Enrolled students must apply by about October 15 through the WVU liaison officer, Prof. John C. Super, Department of History, 202-J Woodburn Hall.

Marshall Scholarships

Marshall Scholarships are awarded annually to about thirty graduating seniors for two years of study in a British university. University endorsement of applicants is required, and seniors interested should contact the WVU liaison officer, Prof. John C. Super, Department of History, 202-J Woodburn Hall, before the end of September.

Completed applications must be in Philadelphia by a date set annually by the program, usually in the second half of October.

National Research Awards, HEW

National Research Award (NRS) legislation authorizes the National Institutes of Health (NIH), the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA), and the Division of Nursing (DN), Health Resources Administration, to support predoctoral and postdoctoral trainees directly through individual fellowships and indirectly through institutional or training grants in specified areas of biomedical and behavioral research.

ADAMHA supports predoctorals through both institutional grants and individual fellowships. For information on the ADAMHA programs write to the appropriate grants management officer at the following addresses: National In-

stitute of Mental Health or Alcohol Abuse, 5600 Fisher Lane, Rockville, MD 20852; or National Institute of Drug Abuse, 11400 Rockville Pike, Rockville, MD 20852.

DN supports predoctorals through both institutional grants and individual fellowships. For information on the DN program write to the Division of Nursing, Federal Center Building 2, 3700 East West Highway, Hyattsville, MD 20782.

NIH, on the other hand, provides predoctoral support only through the institutional grant. Inquiries concerning this kind of support should be directed to the graduate or medical dean of the institution where you would like to study.

NSF Graduate Fellowships and NSF Minority Graduate Fellowships

The National Science Foundation is supporting approximately 420 new Graduate Fellowships and 50 new Minority Graduate Fellowships, each renewable, with satisfactory progress toward an advanced degree, for a second and third year. These awards, limited to U.S. citizens or nationals, are intended for study in the fields of the mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. Members of racial or ethnic minorities are encouraged to apply under both programs. Stipends are \$3,900 for 12-month tenures.

Information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, N.W., Washington, DC 20418. It is the applicant's responsibility to select a graduate school and obtain admission to it, to take GRE tests not later than the December test date, and to file the completed application by deadlines that are set at about the end of November.

Oak Ridge Associated Universities

West Virginia University is one of the sponsors of Oak Ridge Associated Universities (ORAU), a nonprofit, education and research management corporation of 43 colleges and universities. ORAU, established in 1946, conducts programs of research, education, information, and human resource development for a variety of government and private organizations. It is particularly interested in three areas: energy, health, and the environment.

Among ORAU's activities are competitive programs to bring undergraduate and graduate students and faculty members to work on research problems at the research facilities of the Department of Energy (DOE). Participants are selected by ORAU and the staffs of the facilities participating in the ORAU programs, which are Oak Ridge National Laboratory; the Oak Ridge Y-12 Plant; the Oak Ridge Gaseous Diffusion Plant; the Atmospheric Turbulence and Diffusion Laboratory in Oak Ridge; the Savannah River Laboratory and Savannah River Ecology Laboratory in Aiken, S.C.; the Comparative Animal Research Laboratory in Oak Ridge; the Puerto Rico Nuclear Research Center; and the Energy Research Centers in Bartlesville, Okla., Pittsburgh, Pa., and Morgantown. The ORAU Institute for Energy Analysis, the Special Training Division, the Medical and Health Sciences Division, and its other programs also are open to qualified students and faculty members.

Graduate. The ORAU Laboratory Graduate Participation Program enables a candidate for an advanced degree, upon completion of all requirements for work-in-residence — except research — to work toward completion of the stu-

dent's research problem and preparation of the thesis at one of the participating sites.

Undergraduate. The ORAU Undergraduate Research Training Program offers juniors majoring in the sciences, engineering, and mathematics an opportunity to spend 10 weeks during the summer working in directed research programs at these sites.

Faculty. Faculty members of WVU, under the ORAU Faculty Research Participation Program, can go to a DOE facility for varying periods up to three months, for advanced study and research. It is also possible to combine a sabbatical with a longer appointment.

Stipends. Student stipends are at fixed rates that change from time to time. Faculty stipends are individually negotiated, based upon the current University salary.

A copy of the bulletin and announcement of the ORAU-DOE university-laboratory programs is available in the WVU Grants and Contracts Office. Bulletins also may be obtained by writing to the University Programs Office, Oak Ridge Associated Universities, Inc., Box 117, Oak Ridge, TN 37830.

Interested persons should ask for assistance from Dr. Stanley Wearden, Dean, WVU Graduate School, who serves as the ORAU Counselor at WVU.

Rhodes Scholarships

Open to men and women, Rhodes Scholarships provide for two years of study at Oxford University in England, with a third year possible in exceptional cases.

Applications must be received in Charleston before the end of October, addressed to Prof. Robert E. DiClerico Department of Political Science, 315-C Woodburn Hall, West Virginia University, Morgantown, WV 26506. The United States headquarters address is Rhodes Scholarship Office, Wesleyan University, Middletown, CT 06457.

Since a WVU faculty group will file its appraisal of candidates, students applying should notify the WVU liaison officer, Prof. Rodger Yeager, 2112 Agricultural Sciences Building, at least two weeks before the due date.

Additional Reference to Fellowship Opportunities

"A Selected List of Major Fellowship Opportunities and Aids to Advanced Education for United States Citizens" provides excellent short summaries concerning sources of support for graduate study and research. Obtainable from the Fellowship Office, Office of Scientific Personnel, National Research Council, 2101 Constitution Ave., Washington, DC 20418.

Part 7

GRADUATE FACULTY

Emeriti

Vicente Anido, M.D. (U. Havana), *Clinical Professor Emeritus of Pathology.*
Chester A. Arents, M.E. (Ore. St. U.), *Dean Emeritus of Engineering.*
Gladys R. Ayersman, M.S. (WVU), *Assistant Professor Emerita of Family Resources.*
Charles Baer, Ph.D. (U. Md.), *Professor Emeritus of Biology.*
Robert D. Baldwin, Ph.D. (Cornell U.), *Professor Emeritus of Education.*
Horace L. Barnett, Ph.D. (Mich. St. U.), *Professor Emeritus of Mycology.*
William A. Bonsall, M.S. (WVU), *Associate Professor Emeritus of Physical Education.*
Laszlo A. Borsay, Ph.D. (U. Pitt.), *Professor Emeritus of Classical Languages.*
J. Paul Brawner, Ph.D. (U. Ill.), *Professor Emeritus of English.*
Thomas J. Brennan, Ed.D. (Bradley U.), *Professor Emeritus of Technology Education.*
Maurice G. Brooks, M.S. (WVU), *Professor Emeritus of Wildlife Management.*
Clifford W. Brown, M.F.A. (Carnegie-Mellon U.), *Professor Emeritus of Music.*
Sara Ann Brown, Ph.D. (Iowa St. U.), *Professor Emerita of Home Economics Education.*
Marjorie Buckholz, Ph.D. (NYU), *Professor Emerita of Social Work.*
Robert B. Burrows, Ph.D. (Ohio St. U.), *Professor Emeritus of Theatre.*
Mary Catherine Buswell, M.A. (WVU), *Associate Professor Emerita of English.*
Russell C. Butler, Ph.D. (Cornell U.), *Professor Emeritus of Agricultural Education and Education.*
John L. Campbell, D.D.S. (Ind. U.), M.S. (U. Md.), *Professor Emeritus of Oral Surgery.*
Thomas S. Canning, M.M. (U. Rochester), *Professor Emeritus of Music.*
Wincie Ann Carruth, Ph.D. (NYU), *Professor Emerita of Physical Education.*
John A. Caruso, Ph.D. (WVU), *Professor Emeritus of History.*
Carl H. Cather, M.S.M.E. (U. Ill.), *Professor Emeritus of Theoretical and Applied Mechanics.*
William H. Childs, Ph.D. (Cornell U.), *Professor Emeritus of Horticulture.*
James H. Clarke, Ph.D. (U. Minn.), *Professor Emeritus of Agricultural Economics.*
John D. Clarkson, M.A. (U. Pitt.), *Professor Emeritus of Art.*
Elizabeth Cometti, Ph.D. (U. Va.), *Professor Emerita of History.*
Earl L. Core, Ph.D. (Columbia U.), *Professor Emeritus of Biology.*
Allen B. Cunningham, Ph.D. (WVU), *Professor Emeritus of Mathematics.*
Quin F. Curtis, Ph.D. (U. Mich.), *Professor Emeritus of Psychology.*
Ottomar F. Cypris, Th.D. (Union Theol. Sem.), *Associate Professor Emeritus of Religious Studies.*
Hannibal A. Davis, Ph.D. (Cornell U.), *Professor Emeritus of Mathematics.*
Montelle Dietrich, M.S. (U. Minn.), *Associate Professor Emerita of Home Economics.*
Barbara A. Drainer, Ed.D. (Columbia U.), *Professor Emerita of Art.*
Richard E. Duncan, Ph.D. (U. Rochester), *Professor Emeritus of Music.*
James C. Eaves, Ph.D. (U. N.C.), *Professor Emeritus of Mathematics.*
Edward S. Elliott, Ph.D. (WVU), *Professor Emeritus of Plant Pathology.*
Clyde N. English, B.A. (Carnegie-Mellon U.), *Professor Emeritus of Music.*
Homer C. Evans, Ph.D. (U. Minn.), *Professor Emeritus of Agricultural Economics.*
Harold V. Fairbanks, M.S. (Mich. St. U.), *Professor Emeritus of Metallurgical Engineering.*
Joe E. Ford, M.S. (WVU), *Professor Emeritus of Theatre.*
Carl M. Frasure, Ph.D. (Ohio St. U.), *Professor Emeritus of Political Science.*
Nicholas W. Fugo, M.D. (U. Chicago), Ph.D. (St. U. Iowa), *Professor Emeritus of Obstetrics and Gynecology.*
Eleanor R. Gibbard, M.A. (WVU), *Associate Professor Emerita of French.*
Harold A. Gibbard, Ph.D. (U. Mich.), *Professor Emeritus of Sociology.*

John A. Gibson, Jr., Ph.D. (MIT), *Professor Emeritus of Chemistry*.
 Joseph A. Golz, M.A. (Columbia U.), *Professor Emeritus of Music*.
 Allen W. Goodspeed, M.F. (Yale U.), *Professor Emeritus of Forest Management*.
 Babette Graf, M.S. (Penn St. U.), *Associate Professor Emerita of Nutrition*.
 Lloyd R. Gribble, Ph.D. (WVU), *Professor Emeritus of Zoology*.
 James L. Hall, Ph.D. (U. Wisc.), *Professor Emeritus of Chemistry*.
 Harry B. Heflin, Ph.D. (U. Pitt), *Professor Emeritus of Education Administration*.
 Francisco Herrera, M.A. (WVU), *Professor Emeritus of Spanish*.
 John L. Hicks, Jr., A.M. (Ind. U.), *Professor Emeritus of English*.
 Arthur N. Hofstetter, Ed.D. (U. Va.), *Professor Emeritus of Education*.
 Charles T. Holland, M.S.E.M. (WVU), *Professor Emeritus of Mining Engineering*.
 Earl Hudelson, Ph.D. (Columbia U.), *Professor Emeritus of Education*.
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 Mary Rose Jones, M.S. (WVU), *Associate Professor Emerita of Family Resources*.
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 Victorine A. Louistall, M.A.L.S. (WVU), *Associate Professor Emerita of Library Science*.
 John C. Ludlum, Ph.D. (Cornell U.), *Professor Emeritus of Geology*.
 Arthur C. McBride, Docteur de l'universite de Bordeaux, *Professor Emeritus of French*.
 Joseph D. McClung, M.S.E.M. (U Pitt), *Professor Emeritus of Mining Engineering*.
 Marvin R. McClung, Ph.D. (Iowa St. U.), *Professor Emeritus of Animal Science*.
 George A. McLaren, Ph.D. (Okla. St. U.), *Professor Emeritus of Nutritional Biochemistry*.
 Warren F. Manning, Ph.D. (Harvard U.), *Professor Emeritus of Romance Languages*.
 Delmas F. Miller, Ph.D. (U. Pitt), *Professor Emeritus of Education*.
 Caroline T. Mudd, M.S.W. (U. Penn), *Associate Professor Emerita of Social Work*.
 Reva Belle Neely, M.E. (Colo. St. U.), *Associate Professor Emerita of Family Resources*.
 Robert H. Neff, Ed.D. (WVU), *Professor Emeritus of Special Education*.
 Ernest J. Nesius, Ph.D. (Iowa St. U.), *Professor Emeritus of Agricultural Economics*.
 Norman O. Olson, D.V.M. (Wash. St. U.), *Professor Emeritus of Veterinary Science*.
 Charles E. Patton, A.M. (Case West. Res. U.), *Professor Emeritus of Art*.
 W. Clement Percival, Ph.D. (SUNY-Syracuse), *Professor Emeritus of Forestry*.
 G. Gordon Pohlman, Ph.D. (Iowa St. U.), *Professor Emeritus of Agronomy*.
 Peter Popovich, Ph.D. (Wash. St. U.), *Professor Emeritus of Chemistry*.
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 Marvin L. Vest, Ph.D. (U. Mich.), *Professor Emeritus of Mathematics*.

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College of Agriculture and Forestry

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 Morris Ingle, Ph.D. (Purdue U.), *Professor of Horticulture and Plant Biochemistry.*
 Walter J. Kaczmarczyk, Ph.D. (Hahnemann Med. C.), *Professor of Genetics and Agricultural Biochemistry.*
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 Robert L. Reid, Ph.D. (Aberdeen U.), *Professor of Animal Nutrition and Agricultural Biochemistry.*
 David A. Stelzig, Ph.D. (N.D. St. U.), *Professor of Plant Pathology and Agricultural Biochemistry.*
 Valentin Ulrich, Ph.D. (Rutgers U.), *Professor of Genetics and Agricultural Biochemistry.*

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*Associate Member.

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 Gary W. Zinn, Ph.D. (SUNY), Associate Professor of Forest Management.

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 John A. Balasko, Ph.D. (U. Wisc.), Professor of Agronomy.
 Bradford C. Bearce, Ph.D. (U. Cal.), Professor of Horticulture and Agricultural Biochemistry.
 Orus L. Bennett, Ph.D. (WVU), Assistant Professor of Agronomy.
 Gary K. Bissonnette, Ph.D. (Mont. St. U.), Associate Professor of Bacteriology.
 Steven H. Blizzard, Ph.D. (WVU), Associate Professor of Horticulture.
 James L. Brooks, Ph.D. (U. Cal.), Associate Professor of Agricultural Biochemistry.
 William B. Bryan,* Ph.D. (Iowa St. U.), Associate Professor of Agronomy.
 Linda Butler, Ph.D. (U. Ga.), Professor of Entomology.
 Dale F. Hindal,* Ph.D. (Iowa St. U.), Assistant Professor of Mycology.
 Morris Ingle, Ph.D. (Purdue U.), Professor of Horticulture and Plant Biochemistry.
 Everett M. Jencks, Ph.D. (Rutgers U.), Associate Professor of Agronomy.
 Walter J. Kaczmarczyk, Ph.D. (Hahnemann Med. C.), Professor of Genetics and Agricultural Biochemistry.
 Robert F. Keefer, Ph.D. (Ohio St. U.), Professor of Agronomy.
 William L. MacDonald, Ph.D. (Iowa St. U.), Associate Professor of Plant Pathology.
 Joginder Nath, Ph.D. (U. Wisc.), Professor of Genetics.
 Tong-Man Ong, Ph.D. (Ill. St. U.), Adjunct Associate Professor of Genetics.
 David O. Quinn,* M.S. (WVU), Professor of Plant Pathology.
 Oscar E. Schubert, Ph.D. (U. Ill.), Professor of Horticulture.
 John C. Sencindiver,* Ph.D. (WVU), Assistant Professor of Agronomy.
 Rabindar N. Singh, Ph.D. (VPI & St. U.), Associate Professor of Agronomy.
 Suman Singha,* Ph.D. (Cornell U.), Assistant Professor of Horticulture.
 Richard M. Smith, Ph.D. (Ohio St. U.), Professor of Agronomy.
 Charles B. Sperow, M.S. (WVU), Professor of Agronomy.
 Thomas Staley, Ph.D. (Ore. St. U.), Assistant Professor of Microbiology.
 David A. Stelzig, Ph.D. (N.D. St. U.), Professor of Agricultural Biochemistry and Plant Pathology.
 Valentin Ulrich, Ph.D. (Rutgers U.), Professor of Genetics and Agricultural Biochemistry.

Willem A. van Eck, Ph.D. (Mich. St. U.), *Professor of Soil Science.*
Robert J. Young, Ph.D. (Ore St. U.), *Associate Professor of Plant Pathology.*

Resource Management

Dale K. Colyer, Ph.D. (U. Wisc.), *Professor of Agricultural Economics; Chairperson.*
Alfred L. Barr, Ph.D. (Okla. St. U.), *Professor of Agricultural Economics.*
Robert G. Diener, Ph.D. (Mich. St. U.), *Professor of Agricultural Engineering.*
Gerald V. Eagan, * Ph.D. (U. Tenn.), *Associate Professor of Agricultural Economics.*
Kendall C. Elliott, * M.S.Ag.E. (WVU), *Associate Professor of Agricultural Engineering.*
Kenneth J. Hock, * Ph.D. (U. Ariz.), *Associate Professor of Agricultural Economics.*
Robert L. Jack, Ph.D. (Penn St. U.), *Professor of Agricultural Economics.*
Warren G. Kelly, Ed.D. (U. Mo.), *Professor of Agricultural Education.*
Marion L. Kimmons, * Ph.D. (U. Mo.), *Associate Professor of Agricultural Mechanics.*
Layle D. Lawrence, Ph.D. (L.S.U.), *Associate Professor of Agricultural Education.*
O. Claude McGhee, Ph.D. (Ohio St. U.), *Professor of Agricultural Education.*
Kenneth D. McIntosh, Ph.D. (U. Wisc.), *Professor of Agricultural Economics.*
Ralph E. Nelson, Ph.D. (U. Minn.), *Professor of Agricultural Economics.*
Paul E. Nesselroad, Ph.D. (Penn St. U.), *Professor of Agricultural Economics.*
Mary C. Templeton, * M.S. (WVU), *Professor of Agricultural Economics.*

College of Arts and Sciences

Biology

Martin W. Schein, Sc.D. (J. Hopkins U.), *Centennial Professor; Chairperson.*
Robert D. Allen, Ph.D. (UCLA), *Associate Professor.*
Herald D. Bennett, Ph.D. (U. Iowa), *Professor.*
Arnold Benson, * M.A. (U. Colo.), *Assistant Professor.*
David F. Blaydes, Ph.D. (Ind. U.), *Associate Professor.*
Roy B. Clarkson, Ph.D. (WVU), *Professor.*
Jesse F. Clovis, Ph.D. (Cornell U.), *Professor.*
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William P. Haller, D.M.A. (N. Tex. St. U.), *Associate Professor*.
Leo Horacek, Ph.D. (U. Kans.), *Professor*.
Barton Hudson, Ph.D. (Ind. U.), *Professor*.
Gerald Lefkoff, Ph.D. (Cath. U. Am.), *Professor*.
Frank E. Lorince, Jr., Ph.D. (U. Rochester), *Professor*.

James E. Miltenberger, D.M.A. (U. Rochester), *Professor*.
 Donald C. Portnoy, D.M.A. (Peabody Cons. Mus.), *Professor*.
 George E. Schafer, Ph.D. (U. Rochester), *Professor; Director, Graduate Studies*.
 June D. Swartwout,* M.M. (WVU), *Associate Professor*.
 H. Gilbert Trythall, D.M.A. (Cornell U.), *Professor; Dean, Creative Arts Center*.
 Christopher Wilkinson,* Ph.D. (Rutgers U.), *Assistant Professor*.

Theatre

Jon Whitmore,* Ph.D. (U. Cal.), *Associate Professor; Chairperson*.
 Mary Kathryn Brindle,* M.A. (WVU), *Assistant Professor*.
 Frank Gagliano,* M.F.A. (Columbia U.), *Claude Worthington Benedum Professor*.
 Patrick B. Murphy,* M.A. (U. Wash.), *Associate Professor*.
 Charles D. Neel, Ph.D. (Cornell U.), *Professor*.
 John C. Whitty, Ph.D. (U. Iowa), *Professor*.

School of Dentistry

Endodontics and Orthodontics

Arthur E. Skidmore,* D.D.S. (WVU), M.S. (U. Iowa), *Professor and Chairperson, Endodontics*.
 William W. Merow, D.D.S. (U. Md.), M.S. (Ohio St. U.), *Professor and Chairperson, Orthodontics*.
 Camillo A. Alberico, D.D.S. (Marquette U.), M.S. (U. Iowa), *Professor of Endodontics*.
 Henry J. Bianco, D.D.S., M.S. (U. Md.), *Professor of Prosthodontics*.
 W. Robert Biddington, D.D.S. (U. Md.), *Professor of Endodontics; Dean, School of Dentistry*.
 James A. Griffin, Jr., D.D.S. (Baylor U.), *Professor of Endodontics*.
 Robert N. Moore, D.D.S. (Northwestern U.), Ph.D. (U. Rochester), *Associate Professor of Orthodontics and Anatomy*.
 James E. Overberger, D.D.S. (U. Pitt), M.S. (U. Mich.), *Professor of Dental Materials*.
 John T. Welch,* D.D.S. (U. Md.), *Professor of Oral Surgery*.

College of Engineering

Aerospace Engineering

Jerome B. Fanucci, Ph.D. (Penn St. U.), *Professor; Chairperson*.
 John L. Loth, Ph.D. (U. Toronto), *Professor*.
 Nathan Ness, Ph.D. (Poly. Inst. Brooklyn), *Professor*.
 George M. Palmer,* Ph.D. (WVU), *Assistant Professor*.
 William Squire, M.A. (U. Buffalo), *Professor*.
 Richard E. Walters, Ph.D. (WVU), *Professor*.

Chemical Engineering

Chin-Yung Wen, Ph.D. (WVU), *Claude Worthington Benedum Professor; Chairperson*.
 Richard C. Bailie, Ph.D. (Iowa St. U.), *Professor*.
 George L. Blackshaw, Ph.D. (N.C. St. U.), *Professor*.
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 James B. Riggs,* Ph.D. (U. Cal.), *Assistant Professor*.
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Civil Engineering

Fred W. Beaufait, Ph.D. (VPI & St. U.), *Professor; Chairperson*.
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Edmund B. Collins,* M.S.Ag.E. (WVU), *Professor*.
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Hota V. S. GangaRao, P.E., Ph.D. (N.C. St. U.), *Professor*.
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W. Joseph Head, Ph.D. (Purdue U.), *Associate Professor*.
Charles R. Jenkins, Ph.D. (Okla. St. U.), *Professor*.
Emory L. Kemp, P.E., Ph.D. (U. Ill.), *Professor*.
Larry D. Luttrell, P.E., Ph.D. (Cornell U.), *Professor*.
Lyle K. Moulton, P.E., Ph.D. (WVU), *Professor*.
Edward S. Neumann, P.E., Ph.D. (Northwestern U.), *Associate Professor*.
William A. Sack, P.E., Ph.D. (Mich. St. U.), *Professor*.
H. Jayalath Siriwardane,* Ph.D. (VPI & SU), *Assistant Professor*.
Stan Zagajeski,* Ph.D. (U. Cal.-Berkeley), *Assistant Professor*.

Electrical Engineering

Ronald L. Klein, Ph.D. (U. Iowa), *Professor; Chairperson*.
M. Dayne Aldridge, D.Sc. (U. Va.), *Professor*.
Constantine A. Balanis, Ph.D. (Ohio St. U.), *Professor*.
Edwin C. Barbe,* M.S.E.E. (WVU), *Assistant Professor*.
Walton W. Cannon, Ph.D. (U. Ill.), *Professor*.
Wils L. Cooley, Ph.D. (Carnegie-Mellon U.), *Professor*.
James F. Corum,* Ph.D. (Ohio St. U.), *Assistant Professor*.
Everett C. Dubbe,* B.S.E.E. (S.D. St. U.), *Associate Professor*.
Zaglol S. El-Razaz,* Ph.D. (McMaster U.), *Visiting Assistant Professor*.
Mark A. W. Hill,* Ph.D. (WVU), *Assistant Professor*.
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Wasfy B. Mikhael, Ph.D. (Concordia U.), *Associate Professor*.
Roy S. Nutter, Jr.,* Ph.D. (WVU), *Associate Professor*.
Nelson S. Smith, Jr., D.Sc. (U. Pitt), *Professor*.
Robert E. Swartwout, Ph.D. (U. Ill.), *Professor*.

Industrial Engineering

Thomas P. Cullinane, Ph.D. (VPI & St. U.), *Professor; Chairperson*.
Jack Byrd, Jr., P.E., Ph.D. (WVU), *Professor*.
Robert C. Creese,* P.E., Ph.D. (Penn St. U.), *Associate Professor*.
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Samy E. G. Elias, Ph.D. (Okla. St. U.), *Claude Worthington Benedum Professor of Transportation*.
Robert D. Fowler,* P.E., M.S.I.E. (Ga. Tech.), *Professor*.
Donald L. Gochenour, Jr., P.E., Ph.D. (WVU), *Professor*.
Wafik H. Iskander,* P.E., Ph.D. (Tex. Tech. U.), *Assistant Professor*.
Arup K. Mallik, P.E., Ph.D. (N.C. St. U.), *Associate Professor*.
L. Ted Moore,* Ph.D. (Rice U.), *Assistant Professor*.
Ralph W. Plummer, P.E., Ph.D. (WVU), *Associate Professor*.
Terrence J. Stobbe,* Ph.D. (U. Mich.), *Assistant Professor*.
Curtis J. Tompkins, Ph.D. (Ga. Tech.), *Professor*.
Richard E. Ward,* P.E., Ph.D. (WVU), *Associate Professor*.

Mechanical Engineering and Mechanics

Robert D. Slonneger, * M.S.M.E. (U. Tex.), *Professor; Acting Chairperson.*
James F. Avery, * Ph.D. (Penn St. U.), *Assistant Professor.*
Richard A. Bajura, Ph.D. (U. N. Dame), *Professor.*
Russell K. Dean, * Ph.D. (WVU), *Assistant Professor.*
Hasan T. Gencsoy, * M.S.M.E. (WVU), *Professor.*
Russell R. Haynes, Ph.D. (WVU), *Associate Professor.*
Eric K. Johnson, Ph.D. (U. Wisc.), *Associate Professor.*
Robert B. Martin, Ph.D. (WVU), *Associate Professor.*
In-Meei Neou, Ph.D. (Stanford U.), *Professor.*
John E. Notestein, * M.S.M.E. (Purdue U.), *Adjunct Associate Professor.*
Atul R. Padhye, * Ph.D. (VPI & St. U.), *Assistant Professor.*
Augustine A. Pitrolo, * B.S.M.E. (WVU), *Adjunct Professor.*
Helen L. Plants, M.S.C.E. (WVU), *Professor.*
William R. Powell, Ph.D. (Stanford U.), *Associate Professor.*
Nicholas J. Salamon, Ph.D. (Northwestern U.), *Associate Professor.*
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L. Zane Shuck, Ph.D. (WVU), *Adjunct Professor.*
John E. Sneckenberger, Ph.D. (WVU), *Professor.*
Emil J. Steinhardt, Ph.D. (U. Pitt), *Professor.*
Larry D. Strickland, * Ph.D. (WVU), *Adjunct Associate Professor.*
Wallace S. Venable, Ed.D. (WVU), *Assistant Professor.*

College of Human Resources and Education

Counseling and Guidance and Rehabilitation Counseling

Jeffrey K. Messing, Ed.D. (Syracuse U.), *Professor; Chairperson.*
Thomas L. Blaskovics, Ph.D. (U. Wisc.), *Associate Professor.*
L. Sherilyn Cormier, Ph.D. (Purdue U.), *Professor.*
William H. Cormier, Ed.D. (U. Tenn.), *Professor.*
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Edward E. Jacobs, Ph.D. (Fla. St. U.), *Associate Professor.*
Robert P. Marinelli, Ed.D. (Penn St. U.), *Associate Professor.*
Robert L. Masson, Ed.D. (SUNY — Buffalo), *Professor.*
David J. Srebalus, Ed.D. (Ind. U.), *Professor.*
Roy H. Tunick, Ed.D. (U. N. Colo.), *Associate Professor.*
Michael T. Yura, Ph.D. (Ohio St. U.), *Associate Professor.*

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Paul R. McGhee, Ph.D. (Syracuse U.), *Associate Professor; Chairperson.*
Barbara T. Bontempo, * Ed.D. (Ind. U.), *Assistant Professor.*
W. Scott Bower, Ph.D. (Ohio St. U.), *Associate Professor.*
John L. Carline, Ph.D. (Syracuse U.), *Professor; Associate Dean.*
Urban Couch, M.F.A. (Cranbrook Acad. Art), *Adjunct Professor.*
Ardeth M. Deay, * Ph.D. (Cornell U.), *Associate Professor.*
Sandra B. DeCosta, * Ed.D. (WVU), *Assistant Professor.*
J. William Douglas, Ph.D. (Ohio St. U.), *Adjunct Professor.*
J. Christopher Eisele, Ph.D. (Ohio St. U.), *Assistant Professor.*
Robert Elkins, Ph.D. (U. Kans.), *Adjunct Professor.*
David A. England, Ph.D. (Ind. U.), *Associate Professor.*
Patricia K. Fehl, Ed.D. (Ind. U.), *Professor.*
Boyd D. Holtan, Ed.D. (U. Ill.), *Professor.*
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Robert L. Kurucz, Ph.D. (Ohio St. U.), *Adjunct Professor*.
 Layle Lawrence, Ph.D. (Kans. St. U.), *Associate Professor*.
 Betholene F. Love, Ed.D. (WVU), *Adjunct Professor*.
 O. Claude McGhee, Ph.D. (Ohio St. U.), *Adjunct Professor*.
 C. Everett Marcum, H.S.D. (Ind. U.), *Adjunct Professor*.
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 Patricia A. Obenauf, Ed.D. (U. Va.), *Associate Professor*.
 Franklin Parker, Ed.D. (Geo. Peabody C.), *Claude Worthington Benedum Professor of Education*.
 Perry D. Phillips, Ed.D. (WVU), *Associate Professor*.
 Helen Plants, M.S.C.E. (WVU), *Adjunct Professor*.
 Ronald L. Redick, Ph.D. (Ohio St. U.), *Associate Professor*.
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 Arthur R. Solomon, * Ph.D. (U. Ill.), *Assistant Professor*.
 Cynthia C. Sunal, * Ph.D. (U. Md.), *Assistant Professor*.
 Dennis W. Sunal, Ph.D. (U. Mich.), *Assistant Professor*.
 Wallace S. Venable, Ed.D. (WVU), *Adjunct Assistant Professor*.
 Charles E. Wales, Ph.D. (Purdue U.), *Adjunct Professor*.
 Charles D. Wilhelm, * Ed.D. (U. Fla.), *Assistant Professor*.
 Mary I. Yeazell, Ed.D. (U. Ill.), *Professor*.

Education Administration

James A. Martin, Ed.D. (U. Tenn.), *Professor; Chairperson*.
 John O. Andes, Ed.D. (U. Fla.), *Professor*.
 Nell C. Bailey, Ed.D. (Ind. U.), *Assistant Professor*.
 Laddie R. Bell, Ed.D. (U. Va.), *Professor; Assistant Dean — Off-Campus Education*.
 John D. Brisbane, Ed.D. (WVU), *Assistant Professor; Dean, Admissions and Records*.
 Gene A. Budig, Ed.D. (U. Nebr.), *Professor; President, West Virginia University*.
 Charles W. Edwards, Ph.D. (U. Iowa), *Associate Dean, Education Administration, Marshall U.*
 Neil L. Gibbins, Ph.D. (Ohio St. U.), *Professor*.
 Ernest R. Goeres, Ph.D. (U. Iowa), *Associate Professor; Assistant Dean*.
 Harold I. Goodwin, Ph.D. (U. Calif.), *Professor*.
 Billy K. Gordon, * Ed.D. (U. Ky.), *Associate Professor*.
 Robert B. Hayes, Ed.D. (U. Kans.), *Professor; President of Marshall University*.
 Richard H. Hunt, * Ph.D. (Ohio St. U.), *Assistant Professor*.
 Olen E. Jones, Jr., * Ph.D. (Northwestern U.), *Associate Professor*.
 Paul A. Leary, Ed.D. (U. Mass.), *Professor*.
 H. Edward Lilley, Ph.D. (Tex. A&M U.), *Assistant Professor*.
 Zane McCoy, Ph.D. (Ohio St. U.), *Professor*.
 Richard F. Meckley, Ph.D. (Ohio St. U.), *Professor*.
 William G. Monahan, Ed.D. (Mich. St. U.), *Professor; Dean*.
 Philip Rusche, Ed.D. (U. Rochester), *Professor; Dean, Education Administration, Marshall University*.
 Edwin R. Smith, Ed.D. (WVU), *Associate Professor*.
 George D. Taylor, * Ph.D. (Ill. St. U.), *Associate Professor; Vice-President, Student Affairs*.
 Jack E. Yeager, * Ed.D. (VPI & SU), *Associate Professor*.
 Ken M. Young, Ed.D. (VPI & SU), *Associate Professor*.

Educational Psychology

Benjamin H. Bailey, Ed.D. (U. Fla.), *Professor; Chairperson*.
 Stephen W. Ahrens, * Ph.D. (LSU), *Assistant Professor*.
 Sheldon R. Baker, Ed.D. (Case West. Res. U.), *Associate Professor*.

Lawrence E. Fraley, Ed.D. (U. So. Cal.), *Associate Professor*.
 John T. Grasso,* Ph.D. (Ohio St. U.), *Assistant Professor*.
 Richard D. Howard,* Ph.D. (VPI & St. U.), *Assistant Professor*.
 Daniel E. Hursh, Ph.D. (U. Kans.), *Associate Professor*.
 Rogers McAvoy, Ph.D. (Ind. U.), *Professor*.
 Pamela M. Meadowcroft,* Ph.D. (U. Pitt), *Assistant Professor*.
 Anne H. Nardi, Ph.D. (WVU), *Associate Professor*.
 John J. Paterson, Ed.D. (Mich. St. U.), *Professor*.
 Floyd L. Stead, Ed.D. (WVU), *Associate Professor*.
 Meng-shu Tseng, Ed.D. (Ind. U.), *Professor*.
 Ernest A. Vargas, Ph.D. (U. Pitt), *Associate Professor*.
 Julie S. Vargas, Ph.D. (U. Pitt), *Professor*.
 Richard T. Walls, Ph.D. (Penn St. U.), *Professor*.
 Michael D. Wesolowski, Ph.D. (S. Ill. U.), *Assistant Professor*.
 William R. Williams, Ed.D. (WVU), *Adjunct Assistant Professor*.

Family Resources

Joann L. Guthrie,* M.S. (WVU), *Associate Professor; Chairperson*.
 Margaret J. Albrink, M.D. (Yale U.), *Adjunct Professor; Professor of Medicine*.
 Wanda K. Franz, Ph.D. (WVU), *Assistant Professor*.
 Mary K. Head, Ph.D. (Purdue U.), *Associate Professor*.
 Nora M. MacDonald,* M.S. (Iowa St. U.), *Assistant Professor*.
 M. Zafar Nomani, Ph.D. (Rutgers U.), *Assistant Professor*.
 Jacquelynn W. O'Palka, Ph.D., (Penn. St. U.), *Associate Professor*.
 Betty Lou Ramsey,* M.S. (U. Tenn.), *Associate Professor*.
 Dottie D. Rauch,* M.Ed. (Penn St. U.), *Assistant Professor*.
 Sharon S. Redick,* Ph.D. (Iowa St. U.), *Associate Professor*.
 Alan R. Sack,* Ph.D. (VPI & St. U.), *Assistant Professor*.
 John A. Shultz, Ph.D. (Ohio St. U.), *Professor*.
 Cynthia C. Sunal,* Ph.D. (U. Md.), *Assistant Professor*.
 Richard J. Venjohn,* Ph.D. (Purdue U.), *Assistant Professor*.
 Ruth E. Weibel,* M.S. (U. Tenn.), *Associate Professor*.
 Janice I. Yeager,* M.S. (U. Ill.), *Associate Professor*.

Health Education

Bill R. Carlton, Ed.D. (U. Tenn.), *Associate Professor; Chairperson*.
 R. John C. Pearson, M.D. (U. Cambridge), M.P.H. (Yale U.), *Professor*.
 Kenneth J. Simon, Ed.D. (Columbia U.), *Associate Professor*.

Reading

Lawrence G. Erickson, Ph.D. (U. Wisc.), *Professor; Chairperson*.
 Marilyn M. Fairbanks, Ed.D. (WVU), *Associate Professor*.
 Thomas C. Hatcher, Ph.D. (Ohio St. U.), *Professor*.
 John P. Helfeldt, Ph.D. (Syracuse U.), *Associate Professor*.
 Betsy M. Hobbs, Ed.D. (WVU), *Assistant Professor*.
 Jerilyn K. Ribovich,* Ph.D. (U. Md.), *Associate Professor*.
 Martin Saltz, Ph.D. (U. Conn.), *Associate Professor*.
 Patricia K. Smith,* Ed.D. (WVU), *Associate Professor*.

Research and Training and Related Programs

Joseph B. Moriarty,* Ph.D. (Fordham U.), *Professor; Director of Research and Training Center*.
 Ranjit K. Majumder, Ph.D. (U. Okla.), *Professor; Assistant Dean; Director, Research, Rehabilitation Research and Training Center*.

Kathryn B. Greever,* Ed.D. (WVU), *Associate Professor; Director of University Affiliated Center.*

John D. Cone, Ph.D. (U. Wash.), *Research Associate.*

Joann L. Guthrie,* M.S. (WVU), *Research Associate.*

David G. Temple, Ph.D. (U. Va.), *Research Associate.*

Meng-shu Tseng, Ed.D. (Ind. U.), *Research Associate.*

Richard T. Walls, Ph.D. (Penn. St. U.), *Research Associate.*

Michael D. Wesolowski,* Ph.D. (S. Ill. U.), *Assistant Professor.*

Special Education

Wilfred D. Wienke,* Ed.D. (U. N. Colo.), *Professor; Chairperson.*

J. Eugene Clements, Ed.D. (U. Kans.), *Associate Professor.*

Louise A. Kaczmarek, Ph.D. (U. Rochester), *Assistant Professor.*

Thomas P. Lombardi, Ed.D. (U. Ariz.), *Professor.*

Gabriel A. Nardi, Ph.D. (U. Wisc.), *Professor.*

Fred P. Orellove,* Ph.D. (U. Ill.), *Assistant Professor.*

John S. Platt, Ed.D. (U. Kans.), *Associate Professor.*

Annette Shuck,* Ed.D. (WVU), *Assistant Professor.*

Speech Pathology and Audiology

Norman J. Lass, Ph.D. (Purdue U.), *Professor; Chairperson.*

Carolyn P. Atkins,* Ed.D. (WVU), *Assistant Professor.*

Wayne G. Bodenhemier,* Ph.D. (U. Pitt), *Associate Professor.*

Margaret F. Carlin,* Ph.D. (Wichita St. U.), *Assistant Professor.*

Leonard M. Davis, Ph.D. (Northwestern U.), *Professor.*

Louise A. Kaczmarek,* Ph.D. (U. Rochester), *Assistant Professor.*

Dennis M. Ruscello,* Ph.D. (U. Ariz.), *Assistant Professor.*

Kenneth O. St.Louis,* Ph.D. (U. Minn.), *Assistant Professor.*

Mary Ellen Tekieli,* (U. Okla.), *Associate Professor.*

Technology Education

Paul W. DeVore, Ed.D. (Penn St. U.), *Professor; Chairperson.*

David L. DePue,* Ph.D. (Ohio St. U.), *Associate Professor.*

David L. McCrory,* Ph.D. (Case West. Res. U.), *Associate Professor.*

George G. Maughan,* Ed.D. (WVU), *Assistant Professor.*

Edward C. Pytlík,* Ph.D. (Iowa St. U.), *Assistant Professor.*

Interdisciplinary Programs

African Studies

Robert H. Maxwell, Ph.D. (Cornell U.), *Professor of Resource Management.*

Vance Q. Alvis, Ph.D. (U. Va.), *Professor of Economics.*

Gerald C. Anderson, Ph.D. (U. Mo.), *Professor of Animal Science.*

Wesley M. Bagby, Ph.D. (Columbia U.), *Professor of History.*

Philip Bordinat, Ph.D. (U. Birmingham, Eng.), *Professor of English.*

Thomas C. Campbell, Jr., Ph.D. (U. Pitt), *Professor of Economics.*

Robert S. Dunbar, Jr., Ph.D. (Cornell U.), *Professor of Animal Science.*

Philip J. Faini,* M.M. (WVU), *Professor of Music.*

Mannon E. Gallegly, Jr., Ph.D. (U. Wisc.), *Professor of Plant Pathology.*

Henry W. Hurlbutt, Jr., Ph.D. (U. Md.), *Professor of Biology.*

Robert M. Maxon, Ph.D. (Syracuse U.), *Associate Professor of History.*

Robert F. Munn, Ph.D. (U. Mich), *Professor of Library Science.*

Franklin Parker, Ed.D. (Geo. Peabody C.), *Claude Worthington Benedum Professor of Education.*

Janice Spleth,* Ph.D. (Rice U.), Assistant Professor of French.
 James A. Welch, Ph.D. (U. Ill.), Professor of Animal Science.
 Rodger D. Yeager, Ph.D. (Syracuse U.), Associate Professor of Political Science.
 Dale W. Zinn, Ph.D. (U. Mo.), Professor of Animal Science; Dean, College of Agriculture and Forestry.

Biomedical Sciences — Marshall University

Eugene Aserinsky, Ph.D. (U. Chicago), Adjunct Professor of Biomedical Sciences; Professor of Physiology, Marshall University.
 Robert Belsha, M.D. (U. Ill. C. Med.), Adjunct Professor of Biomedical Sciences; Professor of Microbiology, Marshall University.
 Richard A. Gilmore, Ph.D. (U. Cal.), Adjunct Associate Professor of Biomedical Sciences; Associate Professor of Biochemistry, Marshall University.
 Terry W. Fenger,* Ph.D. (S. Ill. U.), Adjunct Assistant Professor of Biomedical Sciences; Assistant Professor of Microbiology, Marshall University.
 John W. Foster,* Ph.D. (Hahnemann Med. C.), Adjunct Assistant Professor of Biomedical Sciences; Assistant Professor of Microbiology, Marshall University.
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 Maurice A. Mufson, M.D. (NYU C. Med.), Adjunct Professor of Biomedical Sciences; Professor of Microbiology, Marshall University.
 Gary O. Rankin,* Ph.D. (U. Miss.), Adjunct Assistant Professor of Biomedical Sciences; Assistant Professor of Pharmacology, Marshall University.
 Donald S. Robinson, M.D. (U. Penn), M.S. (U. Vt.), Adjunct Professor of Biomedical Sciences; Professor of Pharmacology, Marshall University.
 Barry E. Watkins, Ph.D. (Mich. St. U.), Adjunct Assistant Professor of Biomedical Sciences; Assistant Professor of Physiology, Marshall University.
 Gary L. Wright, Ph.D. (Ohio St. U.), Adjunct Associate Professor of Biomedical Sciences; Associate Professor of Physiology, Marshall University.

Genetics and Developmental Biology

Joginder Nath, Ph.D. (U. Wisc.), Professor of Genetics; Chairperson, Interdisciplinary Faculty.
 Stephen S. Amato, Ph.D. (NYU), Associate Professor of Pediatrics.
 David F. Blaydes, Ph.D. (Ind. U.), Associate Professor of Biology.
 Donald F. Butcher, Ph.D. (Iowa St. U.), Professor of Statistics.
 Roy L. Butcher, Ph.D. (Iowa St. U.), Professor of Obstetrics and Gynecology.
 Linda Butler, Ph.D. (U. Ga.), Professor of Entomology.
 Franklin C. Cech, Ph.D. (Tex. A&M U.), Professor of Forest Genetics.
 Nyles W. Charon, Ph.D. (U. Minn.), Assistant Professor of Microbiology.
 Robert S. Dunbar, Jr., Ph.D. (Cornell U.), Professor of Animal Science.
 John S. Ellingson, Ph.D. (U. Mich.), Associate Professor of Biochemistry.
 Vincent F. Gerencser, Ph.D. (U. Ky.), Associate Professor of Microbiology.

Oliver M. Neal, Ph.D. (Mich. St. U.), *Professor of Horticulture*.
 Dennis O. Overman, Ph.D. (U. Mich.), *Associate Professor of Anatomy*.
 Robert S. Pore, Ph.D. (U. Cal.), *Associate Professor of Microbiology*.
 Dennis C. Quinlan, Ph.D. (U. Rochester), *Assistant Professor of Biology*.
 Randell W. Reyer, Ph.D. (Yale U.), *Professor of Anatomy*.
 Martin W. Schein, Sc.D. (J. Hopkins U.), *Centennial Professor of Biology and of Behavioral Medicine and Psychiatry*.
 William V. Thayne,* Ph.D. (U. Ill.), *Associate Professor of Statistics*.
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 Valentin Ulrich, Ph.D. (Rutgers U.), *Professor of Genetics and Agricultural Biochemistry*.
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 Barbara Jones, M.D. (U. Utah), *Professor of Pediatrics*.
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 Sam Katz, Ph.D. (Northwestern U.), *Professor of Biochemistry*.
 Edward C. Keller, Jr., Ph.D. (Penn St. U.), *Professor of Biology*.
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